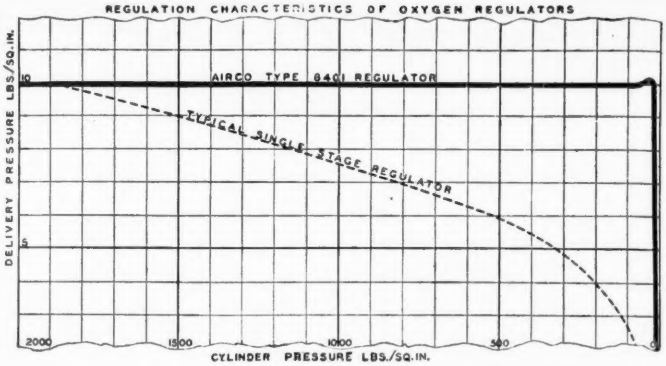
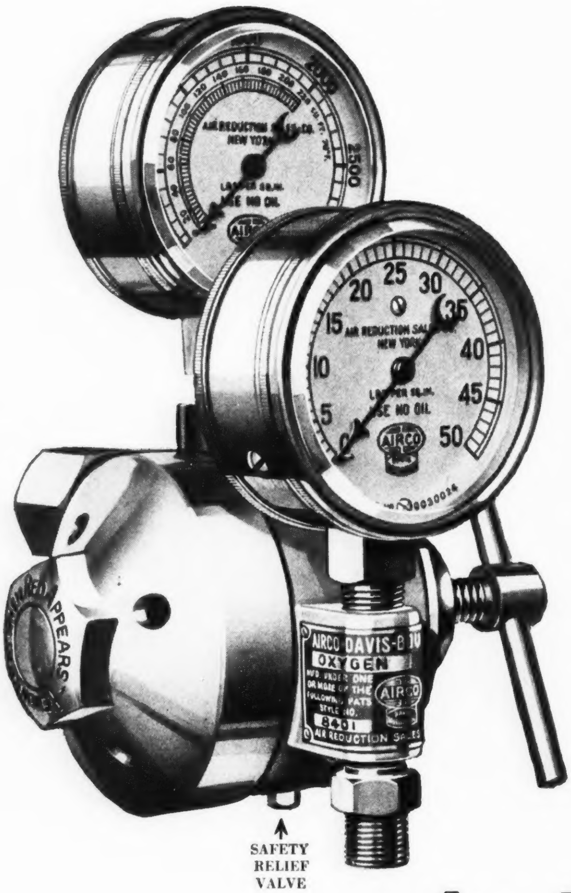
Railway Engineering and Maintenance

JUNE, 1933

The New AIRCO TWO-STAGE REDUCTION OXYGEN *and* ACETYLENE REGULATORS



automatically maintain a set pressure throughout cylinder discharge



SAFETY RELIEF VALVE

THE OXYGEN REGULATOR
STYLE 8401

Look at the performance chart above . . . that straight line representing delivery pressure tells the story. Once these Regulators have been set for a certain delivery pressure, they HOLD that pressure. Automatically they compensate for drop in cylinder pressure, delivering to the torch a constant, non-fluctuating volume of gases. The particular flame desired is maintained without variation. The operator is able to give his undivided attention to the actual welding or heating operation.

But accurate, uniform pressure control is only one advantage of these new Regulators. The entire design is new, and patented features provide new operating convenience, simplify and minimize maintenance and assure trouble-free service.

Priced at an exceptionally reasonable figure, these AIRCO Regulators are in no sense an expense but a means of bettering results and effecting real economies wherever operations are performed which require close regulation of Oxygen, Acetylene and other gas pressures.

Ask for a Demonstration

For full appreciation of their exceptional regulation characteristics, these Regulators must be seen in action. Without obligation, they will be demonstrated to users of gas regulators on request. CALL or WRITE the nearest AIRCO OFFICE.

AIR REDUCTION SALES Co.

General Offices: 60 East 42nd St., New York

Airco Oxygen—Airco Acetylene—Supplies—National Carbide —Airco-Davis-Bournonville Welding and Cutting Apparatus

Oxygen and Acetylene Plants conveniently located thruout the country including cities listed below

DISTRICT OFFICES

Baltimore	Buffalo	Cleveland	Kansas City	Minneapolis	Pittsburgh	Seattle
Bettendorf, Iowa	Charlotte	Dayton	Los Angeles	New Orleans	Portland, Ore.	Shreveport, La.
Birmingham	Chicago	Detroit	Louisville	Oklahoma City	Richmond	St. Louis
Boston	Cincinnati	Jersey City	Milwaukee	Philadelphia	San Francisco	Wheeling

Represented in Texas by Magnolia Airco Gas Products Co., Houston, Beaumont, Wichita Falls, El Paso, Fort Worth and San Antonio
Represented in Canada by Railway & Engineering Specialties Ltd., Toronto, Montreal, Winnipeg

Published monthly by Simmons-Boardman Publishing Company, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions $2.00; Canada, $2.50; Foreign $3.00. Single copies 35 cents. Entered as second class matter at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

BEFORE YOU PAINT YOUR METAL STRUCTURES

TEST
THE PAINT
THIS EASY WAY

● IF YOU'VE had trouble finding a paint that will give your iron and steel structures complete protection against rust and corrosion, you'll be glad to hear about the "Saucer Test."

The "Saucer Test" has been developed to help you study the comparative lasting qualities of paints for metal under approximated service conditions, without the expense and loss of time involved in painting and repainting entire structures. With the "Saucer Test" you can study the effect upon paint of the destructive action of weather, smoke, fumes, salt water or anything else.

The "Saucer Test" will also enable you to compare the durability of Dutch Boy Red-Lead with any other paint. It will prove that this pure red-lead, no matter how exacting the conditions, will protect your property better. In a long series of tests conducted by a leading Southern railroad, the "Saucer Test" proved that pure red-lead outlasted the other paints tested by 4 to 1.

It costs nothing to make this convincing test. We will gladly send you a free "Saucer Test" kit which includes a steel testing saucer, generous sample of Dutch Boy Liquid Red-Lead, set of instructions and a practical booklet about metal paints and painting. Just send the coupon.

DUTCH BOY RED-LEAD

Dutch Boy Red-Lead is a fine, highly oxidized red-lead supplied in two forms—paste and liquid. The paste comes in natural orange red, is readily mixed to brushing consistency and can be tinted to darker colors. Dutch Boy Liquid Red-Lead (ready for the brush) is available in the natural orange red, two shades each of brown and green, and also in black.

NATIONAL LEAD COMPANY

111 Broadway, New York; 116 Oak St., Buffalo; 900 W. 18th St., Chicago; 659 Freeman Ave., Cincinnati; 820 West Superior Ave., Cleveland; 722 Chestnut St., St. Louis; 2240 24th St., San Francisco; National-Boston Lead Co., 800 Albany St., Boston; National Lead & Oil Company of Pennsylvania, 316 Fourth Avenue, Pittsburgh; John T. Lewis & Bros. Co., Widener Building, Philadelphia.

NATIONAL LEAD CO., 111 Broadway, New York, N. Y.

Gentlemen: Please send free kit for making the "Saucer Test."

Address attention of..............................

Firm Name..............................
[REM-6-'33]

Street.................... *City*.................... *State*..........

No. 54 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Commendation that Helps

May 25, 1933.

Dear Reader:

During the month two letters have come to my attention that have interested me greatly. In one of these a division engineer of a large railway wrote his supervisors as follows:

> "I am sending each of you a copy of the March issue of Railway Engineering and Maintenance. Although it is for you to decide whether you should subscribe for this magazine, I find it very interesting and helpful. You will find in it numerous articles that pertain to your daily work, making it possible thereby for you to secure the benefit of other men's views, which should materially aid you in your work."

On another large road in a far different part of the country, another division engineer addressed a letter to more than one hundred of his section foremen, in which he also called attention to the publication, in part, as follows:

> "Railway Engineering and Maintenance, which is published monthly, contains articles on track and bridge work by prominent railway men capable of discussing problems that confront you in your everyday work. A portion of the magazine that will be especially interesting to you is the 'What's the Answer' department, in which questions covering many phases of your daily work are presented and answered by men experienced in the particular problems covered. If you feel that you can possibly afford it, I feel that you will be well advised to subscribe for this magazine, informing your roadmaster of your decision, who will, in turn, pass it on to me."

Letters such as these from supervisory officers to those for whose work they are responsible constitute a tribute to the practical character of the material which we select for publication from month to month. Even more, we regard such evidences of commendation as placing on us a responsibility for maintaining our standards of service to the engineering and maintenance of way departments of the railways.

By the way, these letters may suggest to you a way in which you can bring Railway Engineering and Maintenance to the attention of your associates and make it possible for them to share in these benefits.

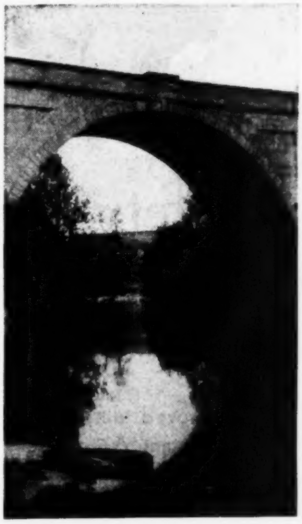
Yours sincerely,

Elmer T. Howson

Editor.

ETH*MB

MEMBER: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.



Published on the last Thursday preceding the month of issue by the

SIMMONS - BOARDMAN PUBLISHING COMPANY

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
17 and H Streets, N. W.

SAN FRANCISCO
58 Main Street

Subscription price in the United States and Possessions, 1 year, $2.00, 2 years, $3.00; Canada, including duty, 1 year, $2.50, 2 years, $4.00; foreign countries, 1 year, $3.00, 2 years, $5.00. Single copies, 35 cents each.

Member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JUNE, 1933

ELMER T. HOWSON
Editor

WALTER S. LACHER
Managing Editor

NEAL D. HOWARD
Eastern Editor

GEORGE E. BOYD
Associate Editor

M. H. DICK
Associate Editor

F. C. KOCH
Business Manager

Railway Engineering and Maintenance

GET BUSY

The Time Has Come for Action

THE turn has come. For three and a half years business has been declining month after month, establishing one low level after another until there would seem to be no end other than complete stagnation. Now a reversal is evident. Business is picking up, employees are being recalled to duty and the entire picture is changing from pessimism to one of hope and encouragement.

Carloadings

The first and most conclusive indication of this change is found within the railway industry itself. For 187 weeks, or since October 17, 1929, carloadings have shown a decrease week after week as compared with the same period of the preceding year. Starting with an average decline of 6.2 per cent in January, 1930, as compared with the same month in 1929, this spread increased to 17.3 per cent in January, 1931, and 21.0 per cent in January, 1932, to a maximum of 34.4 per cent in July of that year. Shortly thereafter a change occurred and since that time the spread has narrowed steadily to 15.8 per cent in January of this year, to 9.7 per cent in April and to 1.8 per cent in the week ended May 6. In the following week, the line was crossed and for the first time in more than three and one-half years the carloadings exceeded those for the corresponding week of the year previous, the increase being 2.6 per cent.

This change is not due to any sudden spurt in business but rather, as shown by the progressive character of the figures, to a steady improvement in business in general. That the record is not confined to the railways is demonstrated by the fact that the consumption of electrical energy, another recognized indication of industrial activity, has exceeded that of a year ago since early in May, the excess for the week ended May 13 being 2.2 per cent, or practically the same as that for carloadings. Another indication of industrial recovery is afforded by steel mill operations which now approximate 40 per cent of capacity, as compared with a minimum of 13 per cent only a few weeks ago.

What will be the effect of a pickup in business on the railways? The first and most immediate effect will be an increase in demand for service. Will the roads be able to meet it? On April 30, they reported 618,000 surplus cars and more than 9,000 surplus locomotives in good order awaiting use. It is no secret, however, that these figures are misleading in that many of these cars and locomotives have been "robbed" of parts to keep other equipment in service and will require close reinspection and the replacement of many parts before they are actually in condition for service. It is recognized also that much of the equipment reported as available for use is obsolete and will probably never again be operated but is held in the records until such time as it can be dismantled and charged off without unduly inflating the operating accounts. There is not, therefore, available for immediate use anything like the amount of equipment indicated by the records, a situation that is of real concern when it is recalled that in the depression of 1921 the recovery was so rapid that a surplus of 470,000 cars early in 1922 was converted into a shortage of 179,000 cars in the fall of that year.

Maintenance of Way

But the problem is not confined to equipment. A similarly serious situation prevails as to maintenance of way. For nearly three years the expenditures for the upkeep of the roadway and structures have been increasingly curtailed until there is now an accumulated deficit of expenditures, as compared with 1925-29 average, of more than $900,000,000. Measured in terms of rails and ties, the accumulated deficiencies in replacements now exceed 3,000,000 tons of rails and 60,000,000 ties; the replacements of other materials are in like proportions.

Every maintenance man knows the significance of such conditions. It is true that the track and structures entered the depression in the best condition in their history. Heavy rail, treated ties, additional ballast, etc., all added to the strength of the track structure. In the years 1923-1929, the railways plowed into their roadways vast reserves of strength which have served them well during the last three years. It is these reserves that have carried them through recent months with such excellent results. It is common knowledge, however, that much of this strength has now been withdrawn, for rail wear has not been made good, tie deterioration has exceeded replacements, ballast has fouled, etc.—in fact, this deterioration has been continuous and universal. As a result, there are in service today more than 200 ties per mile of track that, under normal conditions, would have been replaced, while thousands of miles of rail are still in main tracks that would normally have been relegated to secondary tracks. Such deterioration cannot continue indefinitely without disaster. To condone it longer than is absolutely necessary is to court trouble, even with traffic at its re-

cent low level. With the evidences that traffic is now definitely on the upturn, added expenditures are imperative.

Will the railways repeat past performances? In 1921 they were in the midst of an acute depression, yet by the fall of 1922 they were unable to handle the traffic offered them and in 1923 they were in the midst of the most active maintenance and improvement program in their history.

With the vast accumulation of deferred maintenance that must be made good at a very early date; with a program of improvements to meet new conditions and to reduce operating expenses that averaged $750,000,000 per year until interrupted by the collapse of 1929; with more exacting demands for speed and service in the offing, it is apparent that railway maintenance officers are facing a period of great activity. It is an established fact also that such work can be done most economically when prosecuted in an orderly manner and in advance of heavy traffic. With traffic actually on the upgrade and with material prices rising, it is evident that postponement of work is certain to lead to added cost.

An Opportunity

It has long been the practice of the railways to finance maintenance expenditures out of earnings. This necessitates the postponement of activities until recovery has made substantial progress. Now, however, a new condition exists. For the purposes of providing employment when it is most needed and of aiding in starting the wheels of industry, the national administration is pushing a public works program which, when enacted, will make available some $3,300,000,000 for improvement work of this character.

Included among the possible beneficiaries of the bill, as now drawn, are the railways, which are eligible to borrow at low rates and on reasonable security the sums needed to place their properties in condition to handle traffic which is certain to develop in the near future and which they can repay out of the earnings that will accrue from this traffic. By including the railways in the provisions of this bill, the administration recognizes the public character of railway service; even more, it recognizes the large proportion of railway expenditures that normally go for labor and that will, therefore, contribute to the solution of the present problem of unemployment. With funds available for their use, it is now possible for the railways to undertake their work of rehabilitation at a time when they can do it most economically and, at the same time, make the maximum contribution to employment and to the recovery of business in general.

Work Is Seasonal

There is another aspect to this problem that is peculiar to roadway and structures work. Much of this work is essentially seasonal in character and must be done during the spring and summer months if at all. If not done during the next four or five months, such work will, therefore, have to be postponed until next spring. The present season is already well advanced, yet relatively little has been done to date and maintenance activities are now at a lower ebb than at this season in any year since the depression began. So far as maintenance of way is concerned, therefore, the decision that will be made within the next few weeks will determine the condition of the roadway for another nine months, largely regardless of the recovery in traffic that now appears so close at hand.

Furthermore, maintenance officers must face the fact that as traffic increases and the demands for service mount, they will inevitably be placed in competition with officers of other departments in securing funds for needed improvement work. Because of this fact and buttressed by the seasonal character of their work, maintenance officers should lose no time in compiling and presenting to their managements programs of the most urgent rehabilitation and improvement work in order that their roadway and structures may be placed in condition to enable the railways to handle with safety and with the maximum economy the increased volume of traffic that will soon be offered them.

WEED KILLING

Not a Fad, But a Recognized Necessity

WEED killing can no longer be rated as a fad or a luxury, for it is now recognized by engineering and operating officers alike as a fundamental of good maintenance. This is shown by the discussion of this subject by a large number of representative railway officers, which appears on page 274 of this issue. Starting as a hand operation, weed eradication now includes also chemical destruction, burning, discing, harrowing, mowing and steaming, all designed to insure clean ballast and free drainage for the roadbed and elimination of interference with traction.

Obviously, conditions with respect to the rate of growth, density and persistence of vegetation, vary in different sections of the country, as between roads located in the same general territory and even on different districts of individual roads. Again, the standards of maintenance and the volume and character of the traffic often vary between wide limits as between the individual lines which make up a single railway. There may also be the same variation in the general conditions surrounding the different districts, such as the fire hazard, snow difficulties, local or state laws and other considerations. All of these combine to provide a wide range in the requirements for weed control.

Experience has shown that in many cases a method that is highly effective or economical under one set of conditions may not be adapted for use under other conditions. Some roads endeavor to keep all operated tracks clear of weeds. Others confine this effort to main lines and important branches, exercising only a limited control on lines of lighter traffic. In some sections, considerations of fire or snow hazards make complete eradication on branches equally as important as on main lines.

Originally, weeding was confined to the ballast section, or on dirt track the weeds were scalped with shovels for a sufficient width to insure drainage from the ends of the ties. As methods and equipment have been perfected, the width of the strip affected has increased until at

present many roads practice complete destruction over the full width of the roadbed and mow one or two swaths beyond this limit.

At first thought it would seem that serious duplication of equipment and effort might result from the number of methods that have been developed for controlling weeds. A thorough study finds no support for this impression, however, since the conditions surrounding the application of weed control are so varied that there is a wide field for every type of equipment so far developed. Many roads using chemical applications or burners on main line tracks also disc the shoulders of the ballast one or more times a year and operate a track mower to cut one or two swaths outside of the roadbed. Many of them also use burners, discers or mowers alone or in combination on branches.

A wide difference of opinion is evident with respect to the relative merits of the different methods of weed control. The replies to the questionnaire indicated that these opinions were based largely on individual experience rather than on a community of experience. It was also evident from their discussions that railway men are still open minded on the subject of weed control, that they are willing to be convinced that there are more effective or more economical methods than those they are now following and that they are searching for methods and equipment which can be shown to be superior to those they now use.

VISIT THE FAIR

Railways Take Part in "Century of Progress"

EXHIBITS depicting the progress that has been made in the development of railroad and other forms of transportation during the past 100 years form one of the most important and interesting phases of the Century of Progress Exposition which is being held in Chicago from May 27 to November 1. The transportation exhibits embrace the "Wings of a Century," an historical pageant of transportation; an elaborate outdoor display of modern railroad passenger trains, cars and locomotives, contrasted with some of the earliest forms of equipment; and exhibits of individual railroads and railroad supply companies in the Travel and Transport building as well as in some of the other buildings of the fair.

The Travel and Transport building is in itself an achievement of no small consequence as it embodies a bold departure from the conventional in structural design. The pageant of transportation which is being presented daily in an outdoor theatre that includes a river, a canal, a deep sea harbor front, overland trails and 3,000 ft. of railroad tracks in its setting, comprises a dramatization of the history of transportation in which the railway plays a leading role.

While the objective sought in the exhibits of the railways and railway supply companies is educational—in brief—to show what they have to sell, the manner of presentation differs radically from the ordinary commercial exhibition. Every effort has been made to introduce novel and interest-producing effects, including mural paintings, animated dioramas, miniature railway systems in operation and talking motion pictures. Some of the most modern developments in railway equipment are also displayed and contrasted with replicas of equipment that was in use 100 years ago. But in addition to that which will interest the railway man by reason of its relation to his vocation, the Century of Progress will offer him opportunities to broaden his knowledge of the arts, sciences, industry and commerce on a scale that has not been equalled in a generation.

HIGHWAY BRIDGES

Pavements of These Structures Need Study

JUDGING from the letters that we have received from our readers, the comprehensive study of highway grade crossing construction that was published in last month's issue has proved of great value to maintenance officers. The reason is clear—the status of the grade crossing has entirely changed with the increasing volume of highway transport. But the highway crossing is not the only important point of contact between the railways and the users of the highway, for although the number of overhead highway bridges is small compared with the number of crossings at grade, the greater length of the travel over the bridge intensifies the importance that must be placed on the character of roadway surface provided on these structures.

The problem of the pavement for these bridges has changed greatly in the last 20 years. The traffic handled is much greater, speeds are much higher and loads are much heavier. But what is more important—the highway-using public, having become accustomed to smooth pavements, is much more exacting in its demands. Where once the unevenness in surface produced by the laying of a new plank between two that had been worn down in service excited no comment, such irregularities in surface are now a source of criticism. On the other hand, the designer and the maintenance officer are now afforded a much wider choice of materials for use in the construction of new bridge floors or in the replacement of old ones. In addition to several types of wooden construction, there are various forms of bituminous pavements, and in addition to the concrete surfaces afforded by the all-concrete structure, at least two roads have applied concrete slabs on top of wooden stringers.

Obviously, no one type of pavement can be justified under all conditions, selection being necessarily influenced by the character and density of traffic, and the bearing which they have on the qualities desired. From the standpoint of the user, these are a smooth surface that possesses considerable tractive resistance and a construction that is noiseless under traffic. From the point of view of the railroad, the considerations of most importance are first cost, resistance to distortion or wear under traffic and resistance to deterioration from the action of the elements. To these may possibly be added low maintenance expense and ease in making repairs, but on structures on heavy-traffic routes long life should be given greater weight, because of the difficulties incident to the conduct of repair work under traffic and the objections to the suspending of traffic for repairs.

Weeds in Track Present a Bad Appearance — But More Than This—& Their Presence Is a Source of Real Expense

Is Weed Killing

A discussion of the practices on 34 roads and why and how they endeavor to keep the track and roadbed clear of vegetation

WEEDS provide one of the troublesome and continuing problems for railway maintenance officers. This problem is as old as the railways and in many ways is as acute today as it was in the beginning. No method of weed destruction yet devised produces permanent results, but it must be repeated, in part at least, year after year, and with some methods at least, the work must be done several times in a season. This being so, a number of questions naturally arise—To what extent do the railways endeavor to eradicate weeds? Why do they attempt to eliminate them or control their growth? What is the importance of doing so? How can they do it? Can weed growth be controlled?

For more than three-quarters of a century weed eradication was a hand operation, which was done by the primitive method of hand pulling or by the use of shovels and scuffle hoes. These methods were slow and costly and had the added disadvantage that the period when the weeding must be done came at the height of the tie renewal season when the labor could least be spared from this important feature of track work.

Few data are available from which to obtain the average cost of weed destruction during this period. It is known, however, that even with the relatively low wages that then prevailed, the cost of a single weeding often ran as high as $80 to $100 a mile, and that the operation was frequently repeated two or three times a season. As wages advanced, the cost of weeding increased correspondingly and became a proportionately larger part of the maintenance of way expense, since there was little opportunity to reduce unit costs so long as this remained a hand operation. The economic necessity of reducing this cost has resulted in the development of more modern methods of destroying weeds, including chemical applications, burning, steaming, discing and power mowing.

With a view to finding what the railways consider the important reasons why weeds should be destroyed, the extent to which weed destruction is practiced, the area over which this control is exercised, the methods employed, the relative costs of these methods and the results they accomplish, a questionnaire was addressed to a selected list of executive, operating and maintenance officers representing railways reaching every section of the United States and Canada. Replies were received from 34 roads representing an aggregate line mileage of 180,000. While these officers stated the general policies of the roads with which they are connected and their own views on weed destruction, as developed by their experience, the detailed data they gave refer more particularly to their operation for 1932.

All of the roads replying to the questionnaire stated that it is their policy to keep the tracks on their main lines and important branches clear of weeds at all times. With one or two exceptions the passing sidings on these lines are cared for in the same manner. The practice varies widely, however, with respect to less important branch lines, the passing sidings on these lines and other sidings and yard tracks.

Eighteen of the roads reporting endeavor to keep all operated tracks clear of weeds. Two clean their branch lines once a year; three do so not less than twice; while five attempt only to keep the rails clear in order to prevent wheel slippage. Only one road makes no effort to keep vegetation under control on branch lines, while the remainder exercise various minor methods of control.

Substantially the same practices are in effect with respect to yard tracks and other sidings. Seven of the roads clear these tracks only to the extent necessary to prevent wheel slippage, while four, two of which do not practice complete control on branch-line main tracks and passing sidings, eliminate the weeds currently from yard tracks and sidings. The remainder make it a practice to clear these tracks once or twice a year, as may be deemed necessary to insure good traction.

Why Weed Eradication Is Practiced

In an effort to develop the reasons why it is deemed necessary or desirable to remove weeds from tracks, these officers were asked to outline their objectives in practicing weed eradication and the importance they attach to each. The replies, a summary of which is presented in the table, indicate that there are seven primary reasons why this is done. Two roads made separate tabulations for branch lines, in which they changed the relative order of importance as compared with main lines and others said that this should be done. Several others included further reasons, some of which they ranked as of first or second importance, such as to reduce the fire hazard to stored cars, to eliminate or reduce snow trouble in winter, to facilitate the renewal of ties, to reduce the labor cost of track work, to assist in detecting slight irregularities in line and surface, to improve safety and to conform to state laws.

Principal Reasons for Weed Destruction As Reported by 34 Roads

Objectives	Order of Importance*							
	1	2	3	4	5	6	7	8
To improve appearance	6	6	5	3	6	6	1	
To prevent fouling of the ballast	14	8	3	4	5			
To facilitate drainage	5	15	9	1	3		1	
To retard decay of ties		4	15	6	5	2	2	
To facilitate tie and track inspection		2	2	8	8	11	1	
To reduce interference with locomotive traction	10	2	3	3	5	7	3	1
To stimulate employee morale			1	5		3	17	2

*Figures show number of roads rating each reason, in the order of importance.

Worth While?

An analysis of the answers indicates that the majority of the roads consider that the most important reasons for removing weeds from tracks are to prevent fouling of the ballast and to facilitate drainage. Retardation of decay in ties, improved appearance and reduced interference with traction follow in the order given. Ten roads, however, gave interference with traction as the most important reason. Only a few gave the facilitating of track and tie inspection as an important reason, while considerably more than half of the roads assigned least importance to the stimulation of employee morale. Six roads considered improved appearance to be of first importance; six placed this reason second and five assigned it to third place.

How Traffic Influences Practices

In view of the difference in the practices on some of the roads with respect to destroying weeds on main and branch lines and of the variation in the relative importance assigned to the reasons given for removing weeds from tracks, it is of interest to determine how far these practices and objectives are influenced by the volume of traffic handled and the standards of track construction. Twelve roads asserted that neither the volume or character of traffic nor the standards of track construction is taken into consideration, and three others said that they attach little importance to these matters. Eight stated that the volume of traffic is given first consideration in planning the annual program of weed elimination, while on two roads the volume and character of the passenger traffic exert the largest influence.

The Elimination of Weeds Is One Element in Adequate Drainage

In discussing the effect of traffic on weed elimination, several officers qualified their answers by saying that the volume of traffic determines the amount of revenue received from any particular line and that the allocation of the maintenance appropriations is based largely on the revenue received from the various lines comprising the system. On these roads the volume of traffic has, therefore, in this way a direct influence on the amount of money that is available for weed elimination on any individual line of the system as well as on the total appropriation for this purpose.

Five roads gave the standards of track construction and one road the standards of maintenance as the principal factors in determining the amount and character of the weed elimination work that is to be done. In addition, three roads stated that the total volume, the amount and character of passenger traffic and the standards of track construction are all given weight in distributing the appropriations for this work. Several roads make a point of keeping their rockballasted track free of weeds and then do as much on the remaining lines of the system as appropriations will permit. In commenting on the standards of track construction as a basis for preparing the annual weed-destroying program, attention was called to the fact that these standards are generally determined by the volume and character of the traffic that is handled, so that indirectly the matter is again based on traffic.

Comments on Objectives of Weed Elimination

In commenting on the reasons why it is considered necessary or desirable to remove weeds from tracks, A. D. MacTier, vice-president (now retired) of the Canadian Pacific Eastern Lines, said that "we appreciate the importance of keeping the ballast clear of weeds in order that it may function to the fullest possible extent as a drainage medium and we have not allowed the present abnormal conditions to interfere to any material extent with our work in this connection." "In the territory traversed by our lines," said C. E. Weaver, assistant general manager and chief engineer of the Central of Georgia, "the growth of vegetation is so rapid that if not removed, the interference with locomotive traction affects the operation of both road trains and yard engines. Clean track results in lower maintenance costs, prevents the fouling of the ballast, facilitates drainage and retards the decay of ties. In addition, it creates a favorable impression with patrons."

Similarly, J. T. Loree, vice-president and general manager of the Delaware & Hudson, gave as one important reason, "to curtail weed growth and thus increase the sterility of the ballast, thereby decreasing expenditures from year to year for weed eradication." On the Erie, according to J. C. Patterson, chief engineer maintenance of way, "the principal objectives are to prevent fouling of the ballast, to facilitate drainage and to retard decay in ties."

Located in a section where the growth of vegetation is rapid and heavy during the spring and summer, followed by very dry weather in the fall, the Gulf Coast Lines and the International-Great Northern experience much trouble with fires, which often extend to adjacent ranch lands, causing heavy damage. "For this reason as well as others," said H. R. Safford, executive vice-president, "we consider weed eradication a necessity. Experience shows that there is less churning track because grass roots are kept out of the ballast shoulder. It is also our experience that there is a saving in force equivalent to one man to a section on main-line sections

Clean Track Can Be Maintained for Less Money

where the track is kept clean, since hand cleaning is not required at points where work is being carried on. In other words, the section forces are able to begin track work at any point without wasteful labor in cleaning grass and weeds from the track."

That a similar viewpoint is held by the Northern Pacific is indicated by the statement of H. E. Stevens, vice-president maintenance and operation, that "all of the objectives mentioned are of considerable importance, but we believe the most important are to prevent fouling of the ballast and to improve appearances. We believe that the remaining objectives are of about equal importance, except on some branches where the principal objective is to prevent the stalling of locomotives."

H. M. Lull, executive vice-president of the Texas and Louisiana lines of the Southern Pacific, is of the opinion that "as a normal practice the benefits in improved drainage, clean ballast, retarded decay in ties and the facilitating of track work are sufficient to justify the expense of weed destruction on any main-line tracks that are of sufficient importance to be ballasted. On unballasted branches, industry spurs and yard tracks, the expense of keeping the tracks free of weeds probably cannot be justified from the standpoint of any tangible benefits that may be derived."

As against this, E. P. Bracken, executive vice-president (now retired) of the Chicago, Burlington & Quincy, said that "on our principal main lines where chemical treatment is used, we keep the roadbed clear of weeds between sod lines. On branch lines and sidings weeds are controlled to prevent interference with traffic, to a reasonable extent to permit drainage, avoid snow trouble and permit inspection of ties and track. Our practices are in no way influenced by the volume of traffic."

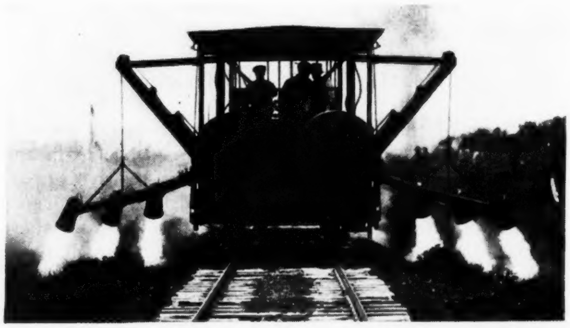
Where Weeds Are Eradicated

The width over which weed eradication is attempted varies as between different roads, on the different lines comprising individual roads and in some instances in accordance with the method of control that is employed. Nineteen of the roads under consideration endeavor to eliminate the weeds between sod lines on main-line tracks; seven restrict this effort to the space between the ballast toe lines; while three extend this action to the limits of the roadbed.

Several of these roads stated, however, that the width of the strip in question depends on the method employed. Typical of this variation in practice, according to R. W. Ball, assistant chief engineer of the Atchison, Topeka & Santa Fe, which in a representative year destroyed the weeds on 6,864 miles of lines, that road sprays chemical destroyers to a distance of 10 ft. from the center line of the track receiving this treatment, but goes out only 8 ft. where steam is employed. Where track mowers are used, they cut a swath 6 ft. wide from the ends of the ties. Similar variations were reported by other roads with respect to weed burners, the width varying from the ballast toe line to the limits of the roadbed. Obviously, discing is confined to the ballast shoulder.

The Methods Employed

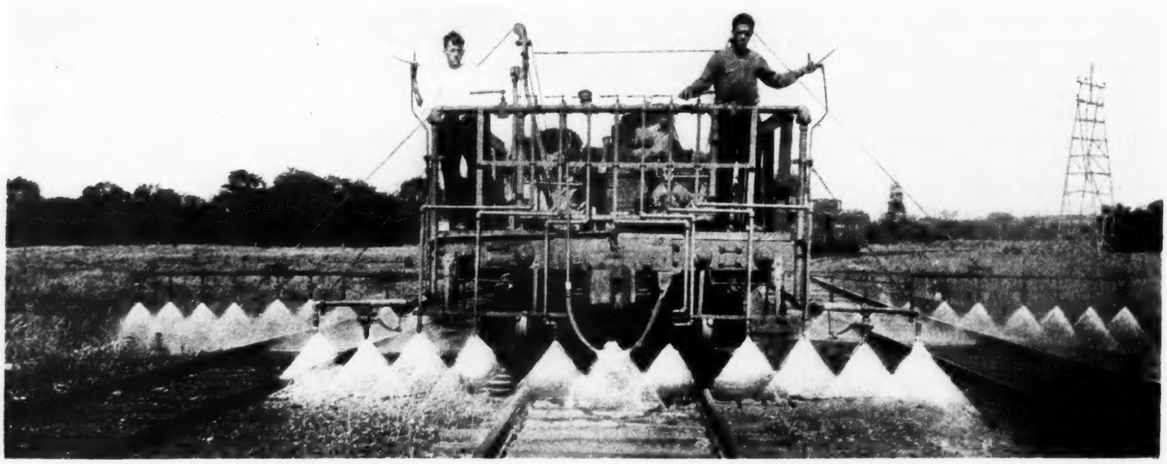
As an evidence of the trend away from hand methods for weed extermination, only three of the roads reported that they followed this practice exclusively, although two said that they do so principally. The officers of these



A Heavy Duty Weed Burner

roads explained, however, that owing to the character of their ballast and the efforts they are making to keep it clean, the weeding of track is not a major operation as it is on some roads. In describing their methods, most of the roads said that regardless of the system of weed destruction employed, there is always a certain amount of hand work that must be done, but that this is usually small.

Other methods used include chemical treatment, burning, steaming, discing and harrowing, mowing, etc. Three roads reported that they use all of these methods; two that they employ chemical treatment exclusively; and two that they rely entirely on weed burners. Nine use both chemical treatment and weed burners, four use weed burners principally, but also do a large amount of discing and harrowing, while eight use chemicals in vari-



A Chemical Application Car Equipped With Wings for the Spraying of a Track on Each Side


Weed Burning Is Effective—Left, Before Burning—Right, After the Second Burning

ous combinations with steaming, harrowing, discing and mowing, and one road depends most largely on discing and harrowing. Practically all of these roads reported that in addition to the efforts they make to keep the roadbed free from weeds, they also do a large amount of mowing, ranging from a single swath on either side of the track with track mowers to the entire right of way, and that the mowing is generally done twice and sometimes three times a year.

A few roads have found that an application of oil acts as a retardant to the growth of weeds. In this connection, Mr. Stevens stated that, "where pitrun gravel is used for ballast, we oil the track to keep the dust down. On these tracks and on branch lines, weed burners seem to be effective, particularly on the oiled track where few weeds grow, since the oil hinders their growth and what few there are are quite stunted." "We use an arsenic weed destroyer where the right of way is fenced," said J. H. Dyer, vice-president of the Pacific System of the Southern Pacific, "but apply a petroleum distillate in yards and in territory where arsenic cannot be applied, and to noxious weeds which are not affected by the arsenic." "On the Texas and Louisiana lines of this road," Mr. Lull said, "we have used all of the methods mentioned and also apply heavy crude-oil sludge to the embankment shoulders beyond the ballast toe line."

Assuming that the method employed is effective, cost becomes a matter of first importance. For this reason, the officers to whom the questionnaire was addressed were asked to give specific information as to the cost of the methods which they follow. In noting these figures, however, it should be borne in mind that while they are, in general, the average for one or more seasons, the cost for any particular section of track will vary with the kind of ballast, the density and character of the vegetation, the rapidity with which it grows, the amount of traffic on the line receiving the treatment and the weather conditions at the time the elimination work is under way.

Statements as to the cost of chemical treatment ranged from \$9.02 a mile a year on the Erie to \$45.95 on the Atchison, Topeka & Santa Fe, with an average of \$23 for all of the 15 roads reporting the cost of this method. This relatively wide range demonstrates the fact that local conditions have a strong influence on the cost of weed eradication. It should be understood too that it is the practice on the Santa Fe to apply a heavy dosage for two or three years and then omit all forms of treatment for two years, so that the average over a five-year period will be considerably less than the figure given.

Other roads that gave costs for this form of control included the Canadian Pacific, \$16 to \$20 a mile a year; Chesapeake & Ohio, \$35; Chicago, Burlington & Quincy, a range in different years from \$15.06 to \$9.47; Chicago, Milwaukee, St. Paul & Pacific, which uses a mixture of creosote and petroleum, \$5 to \$20, with an average of \$14; Kansas City Southern, \$19.86 in 1929, \$27.62 in 1930 and \$23.70 in 1931; Missouri-Kansas-Texas, \$25; Northern Pacific, \$15 an application, two applications the first year and one in succeeding years, with some sections where one application every alternate year may be sufficient; Pennsylvania, \$11.52; Reading, \$18.80; Southern Pacific, Pacific System, \$19 for sodium arsenite, \$27 for "still bottom" or slop distillate; Texas &


The Result of Weed Killing With Chemicals. Left—Before Application. Right—Several Weeks Later

Pacific, $41.30; and Union Pacific, $15.

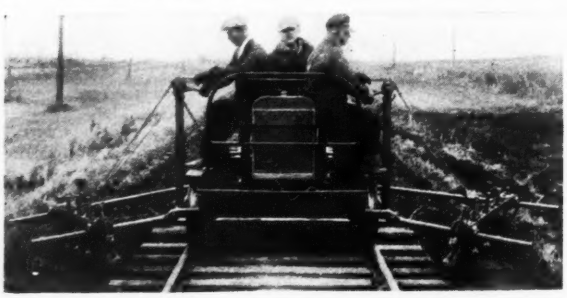
While several roads said that they use steaming as one of the methods they employ for weed control, only two gave figures as to the cost of this method. On the Santa Fe the cost is $13.40 a mile and on the C. & O., $25 a mile a year.

Sixteen roads gave figures as to the cost of operating weed burners. These ranged from $2.50 to $6.48 a mile for one complete burning. Here again it is evident that the kind of ballast, the type of vegetation encountered and the climatic and soil conditions definitely influence the cost of weed control. In the South, with its long growing season and abundant moisture, not only is the cost of a single burning increased, but the number of burnings a year is greater. The roads giving cost figures for this operation included the Central of Georgia, $3.50; Chesapeake & Ohio, a total of $20.65 for three burnings; Chicago & Eastern Illinois, $4.37, including the control of the fire behind the burner; Chicago, Burlington & Quincy, $2.50 to $4, with from one to four burnings necessary during a season; Chicago Great Western, from $2.50 to $5, average $3; Chicago, Milwaukee, St. Paul & Pacific, $3 to $4, and two to six burnings a year; Chicago, Rock Island & Pacific, $4; Great Northern, $3; Gulf Coast Lines and International-Great Northern, $4.22; Kansas City Southern, $3.23 in 1928, $4.64 in 1929, $3.66 in 1930 and $4.40 in 1931; Missouri-Kansas-Texas, $30 for the season; Missouri Pacific, $4 to $6 for one burning, $15 to $25 for an average year; Northern Pacific, $5; Pennsylvania, $5.89, includes two burnings five days apart; Texas & Pacific, $6.48; Union Pacific, $5, with two to three treatments a year being necessary.

A Mower with Extension Arms Cutting a Second Six-Foot Swath on Each Side

Discing and Mowing

While a large number of the roads said that they use track mowers to cut a swath outside of the area affected by the foregoing methods, only five of them gave figures as to cost and these ranged from $1.15 a mile to $5, as follows: Atchison, Topeka & Santa Fe, $2.31; Central of Georgia, $1.15; Gulf Coast Lines and International-Great Northern, $3.24; Missouri Pacific, $3 to $5 a mile for one cutting, $4 to $8 a mile a year; Texas & Pacific, $1.80.



A Ballast Discer at Work

Discing the shoulder of the ballast is a practice that is followed by a number of roads, either in connection with hand weeding as the sole method of weed control, or in combination with other methods. The cost of operating a discer for one mile is relatively low, ranging, according to the eight roads reporting their costs, from $1.25 a mile to $7.50, with an average of about $3.50. These figures were, Central of Georgia, $1.25; Chesapeake & Ohio, $4.62; Delaware & Hudson, $5 for the discer alone, combined with hand weeding between ties, $38; Erie, $1.33; Great Northern, $1.50 to $1.75; Gulf Coast Lines and International-Great Northern, $7.50; Missouri Pacific, $4 to $5 for one trip and $7 to $12 a year; and the Union Pacific, which uses the discer principally to remove salt grass from the ballast shoulder, $1.50.

Hand-Weeding

As already mentioned, a few roads use hand methods exclusively for destroying weeds. The attitude of the officers on these roads was expressed by Earl Stimson, chief engineer-maintenance of the Baltimore & Ohio, who said "most of our weeding of the roadbed is done by hand, using scuffle hoes or shovels, the ballast being dressed to standard at the same time. Considered on the basis of cost per mile, the hand method is the most expensive. It gives better results, however, makes a complete job and, for first-class track where neat appearance is desired, is the best method. Burning, steaming and other weed-killing methods, while very much cheaper, leave the stems standing and the roots in the ballast. Discing and harrowing do not make a complete job, since they leave the vegetation between the ties. We have used all of the other methods, particularly on branch lines where appearance is not so essential."

As was the case with other methods, a wide range of costs was given for hand weeding, varying from $4 a mile to $123.20. On the Canadian Pacific, Mr. MacTier said that this method costs "from $40 to $50 a mile in gravel ballast, and in rock ballast very much more, depending on the size of rock and other conditions." The Chicago Great Western finds that "weeding with scuffle hoes costs from $4 to $12 a mile, depending on the amount and kind of weeds," according to P. H. Joyce, president of this road. Mr. Loree said that on the Delaware & Hudson "hand weeding costs from $38 to $64 a mile."

F. W. Grace, vice-president and general manager of the Missouri-Kansas-Texas, gave $100 a mile a year as the cost of hand weeding on that road, but did not say whether this involved more than once over the track. According to Mr. Stevens, "cost figures which were kept for a limited time on the Northern Pacific indicated that the cost of hand weeding in washed-gravel ballast will average about $75 a mile a year." Specific costs were quoted by E. W. Scheer, vice-president of the Reading,

who said that "on certain branch lines where the weed growth is heavy, we have found that it cost $123.20 a mile to pull weeds by hand. On another branch, hand pulling cost $105.60, whereas chemical treatment, using 60 gal. to the mile and including work-train service, cost only $18.80 a mile." Lem Adams, engineer maintenance of way of the Union Pacific, stated that because "hand weeding is very expensive, we do as little of it as practicable. One treatment costs about $25 and two to four cuttings are required in a season."

Is Ballast Sterile?

It has often been said that weeds never grow in clean ballast. It has also been stated that certain kinds of smelter slag are highly sterile. To develop what the experience has been with reference to this feature of weed control, a question was asked as to whether certain types of ballast, such as crushed rock, are sufficiently sterile or whether the periodic cleaning of ballast is sufficiently effective to reduce the weed nuisance to the point where weed eradication becomes virtually unnecessary; and whether either can be justified economically on this account, compared with any of the means of combating weed growth.

An analysis of the answers indicates that while some of the smelter slags are quite sterile, their use is limited to a few roads and even on these roads to a relatively restricted territory. Chatts, which is produced from zinc and lead ores, probably has the widest use of any ballast of this type. The experience of the Kansas City Southern, as stated by C. E. Johnson, president of this road, is typical. He said, "chatts is sufficiently sterile so that vegetation does not grow in track with which it is ballasted, and this is the only type of ballast in our experience in which weed eradication is unnecessary."

A composite of the replies as to whether other types of ballast are sterile is that substantially all types of ballast, except those already mentioned and with the exception of some pit-run gravels, are free from weeds for two or three years after they are applied. During this period, however, soil is blown in, dirt is dropped from cars and other forms of contamination occur, until eventually enough of these foreign substances have accumulated to allow plant life to obtain a foothold. Having once obtained a foothold, the vegetation is there to stay until the ballast is cleaned or renewed, when the cycle is repeated.

With respect to stone ballast, Mr. Stimson said that "clean crushed rock produces practically no weeds, except the hardier sort that grow up through the ballast near the edge of the section. As stone ballast becomes foul, however, weeds grow in it, particularly in limestone. We never clean stone ballast for the purpose of combating weed growth, but to perfect the drainage and eliminate pumping joints. In doing this, obviously the advantage is also gained of retarding weed growth."

Commenting on this matter, G. D. Brooke, vice-president of the Chesapeake & Ohio and of the New York, Chicago & St. Louis, said that "in certain localities, as in shale country, our limestone ballast is sufficiently sterile to obviate the necessity for systematic cleaning. In country where the soil is heavy, where wire grass and rank growths abound, crushed rock is no deterrent to the weed nuisance."

"There is no type of ballast that is completely sterile," said Mr. Patterson, "nor does periodic cleaning make it so." A similar comment was made with respect to washed gravel by C. O. Jenks, vice-president-operation of the Great Northern, who said that "freshly washed gravel which is, therefore, free from soil, is sufficiently sterile to prevent weeds. Within a few years the ballast becomes fouled with soil blown in from cultivated fields, with droppings from trains, etc., and weed growth usually starts. It is doubtful if washed gravel or crushed stone can be justified economically on the ground of weed elimination."

In support of this position, W. S. Burnett, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis, gave it as his experience that "crushed rock, when clean, has virtually no weed growth, but such ballast cannot be justified on this ground alone." Likewise, J. T. Gillick, vice-president of the Chicago, Milwaukee, St. Paul & Pacific, is convinced that while "the results from chemical treatment are far better where the ballast is of a high grade, it does not seem that crushed rock can be justified solely or economically by reason of the absence of weeds as a result of its sterility."

An Object Lesson in the Sterilizing Effect of a Heavy Dosage of Chemical. Left—Before Application. Right —Twenty-Two Months After the Application Was Made

According to Mr. Grace, his road has not been able "to justify the use of any particular type of ballast solely from the standpoint of combatting weed growth." And Mr. Dyer added that "ballast can only be justified by its mechanical advantages as ballast."

From a somewhat different viewpoint, T. J. Skillman, chief engineer of the Pennsylvania, is sure that since "the periodic cleaning of stone ballast eliminates the weed nuisance entirely, it can be fully justified, as it provides proper drainage, prevents the fouling of the ballast, retards the decay of ties and improves appearances." And Mr. Scheer is of the opinion that "we are justified in cleaning ballast to facilitate drainage, and at the same time remove dirt and weeds from the track."

Do any of the methods of weed eradication result in increasing sterility of the ballast and in decreasing expenditures for killing weeds from year to year? The replies to this question indicated that none of the methods employed except the application of certain chemicals, gives added sterility to the ballast. On the

other hand, it was generally agreed that any method of eradication that is followed persistently will result in less weeds after the first two or three years, provided they are always removed from the track and the right of way is mowed before seeding takes place.

Is the tendency toward sterilization and reduced weeding sufficient to warrant expenditures for heavier treatment for, say, one, two or three years, than would be warranted simply to provide clean track for any one season? It was the general opinion, as reflected in the answers to this question, that for methods other than chemical treatment additional expenditures are not warranted, since none of these methods adds to the sterility of the ballast. For this reason, it was said, the best results can be obtained with these methods only when the weeding of the track and the mowing of the right of way are completed before the weeds and grasses go to seed.

With respect to chemical treatment, however, opinion was somewhat divided. Some of the officers were convinced that there is a cumulative effect which warants a heavy dosage for two or three years, after which the applications can be much lighter or omitted for one or two years. Others recognized that, temporarily at least, the ballast is somewhat sterilized, but did not see the advantage of heavier initial treatment. Still others, apparently, have used chemicals which do not, or in only a minor degree, sterilize the ballast, although they do reduce the amount of vegetation after the first two or three years about the same as the other methods do. They could, therefore, see no advantage in heavier initial treatments.

In his comments, Mr. Ball said that "after two to four consecutive treatments with a rather heavy dosage, rock ballast can be practically sterilized and laid by for a year or two before treatment is again necessary. While the number of gallons to be applied depends on the character of the vegetation, our average application is approximately 175 gal. to the mile." "Heavy treatment for two or three years is warranted," said Mr. Burnett, "to sterilize the ballast to the point that only reseeding from outside sources occurs." In the opinion of Mr. Dyer, "any road starting on a program of chemical weed killing will find it necessary to make a slightly heavier application for the first two years than in subsequent years."

Lem Adams is convinced that chemical treatment increases the sterility of the ballast, and in support of this view said that "chemical application from year to year has practically eliminated weed growth from our main-line ballast section." The same thought was expressed by J. V. Neubert, chief engineer maintenance of way of the New York Central, in his statement that "we have found that continued chemical applications, cleaning and harrowing will reduce the weeds and increase the sterility of the ballast to the point where expenditures for certain years can be reduced."

Opposing that view, in the opinion of Mr. Gillick, "the proper and economical way to handle weed eradication is to give only that treatment which is necessary to provide clean track for the current season." In similar view, J. L. Bevan, senior vice-president of the Illinois Central, stated that while "chemical treatment results in a decreased growth of weeds from year to year, I do not believe this tendency is sufficient to warrant expenditures for heavier initial treatment."

It has been Mr. Lull's experience that "weed growth decreases from year to year, following the regular application of chemical weed destroyers, but judging from the growth now, following two seasons in which the use of the chemical was omitted, we are of the opinion that the sterility obtained by applying the chemical is not of a very lasting character. If the vegetation is sufficient to justify chemical treatment, the amount applied and the degree of concentration would be substantially the same as if there were a heavy growth."

Typical of the comment of the third group was that of Mr. Stevens that "the chemical which we have used does not, we believe, sterilize the ballast to any appreciable extent, but if the weeds are eliminated in the ballast section, the annual germination of fresh seed will be kept to a minimum. We have no information that indicates that a heavier application of chemical than is needed to provide clean track for one year will have any worth-while effect in following years."

In considering these rather diverse opinions with respect to sterilization of the ballast, two points should be kept in mind. First, they are based on experience with the methods employed by the different roads represented in this part of the discussion. The second is that the proof of the pudding lies in the eating. In other words, the Santa Fe is the only road that advised definitely that it had followed the practice of applying a heavier dosage of chemical for the purpose of sterilization. For this reason, Mr. Ball's statement that the experience on his road has shown that sufficient sterilization is effected by this method to permit a periodic suspension of weed-destroying activities for one or two years and that such treatment is warranted becomes an important contribution on the subject. Moreover, two other roads implied that they have followed this method and found it justified by the results, both Mr. Dyer of the Southern Pacific and Mr. Burnett of the Big Four having also indicated that they consider that the cost of heavier initial treatment for one or two years is warranted on the basis of the sterilization that is effected.

Costs per Mile of Various Methods of Weed Destruction
Illinois Central

	Average Cost per Mile			
Year	Chemical Treatment	Ballast Discing	Mowing Machine	Weed Burner
1918	$45.25			
1919	58.80			
1920	63.15			
1921	63.96			
1922	51.90			
1923	45.25	$6.27	$3.17	
1924	28.91	5.24	2.95	$7.60
1925	17.66	3.80	2.09	7.75
1926	13.92	3.39	1.98	8.15
1927	13.46	—	—	8.10
1928	14.24	—	—	7.85
1929	9.96	—	—	7.78

To show the cumulative effect of persistent weed destruction, Mr. Bevan gave the costs per mile per year of the various methods employed by the Illinois Central from 1918 to 1929, inclusive. In considering these figures, however, it should be explained that prior to 1922 the price of arsenic compounds increased more rapidly than other costs could be reduced. This was partly the result of post-war conditions and partly because of the shortage of arsenic created by the fight on the boll-weevil in the South. For this reason, the figures for chemical treatment do not really become comparative until 1924. Bearing this in mind, the figures show quite clearly that, except for one method, the cost of which is nearly constant, there is an accumulative effect that results in reduced expenditures.

It may not be amiss to point out that while certain differences of opinion are apparent in the foregoing discussion, they can be reconciled in large measure by the

(Continued on page 288)

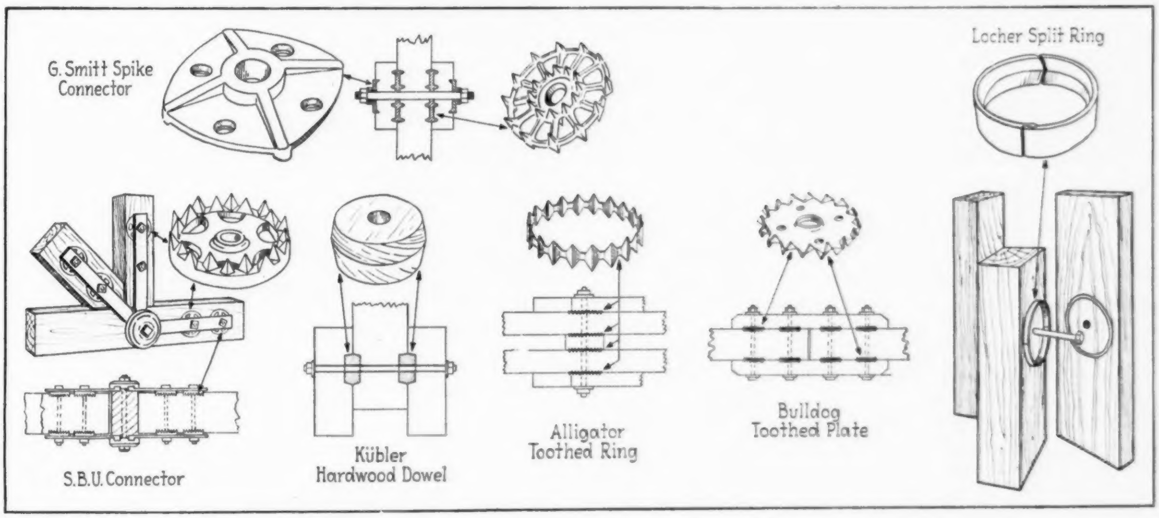
New Connectors Strengthen Wood Joints

Devices developed by European engineers increase the efficiency and broaden the usefulness of timber construction

BECAUSE of the weakness of wood in compression and tension across the grain and in shear parallel with the grain, it has been difficult to develop satisfactory joints for timber frame structures. Until recently designs in this country have depended primarily on bolts, dowels, and keys for the transmission of stress from one member to another and because of their limited efficiency, the designer has had the choice of a rather cumbersome joint or a heavy loss of the potential full strength of the members joined. It is for this reason that considerable interest is being taken in special metal connections that have been developed in Europe and rather widely applied to timber frame structures in the years following the World War.

With the thought of making available in this country such knowledge as has been gained regarding these connectors, as well as developing additional information concerning their structural properties, the National Committee on Wood Utilization of the United States Department of Commerce has compiled data on more than 60 types of wood and metal connectors, on the more promising of which extensive laboratory tests were conducted by the Forest Products Laboratory, Department of Agriculture. The information so obtained has been made available in a handbook entitled "Modern Connectors for Timber Construction," which was issued jointly by the National Committee on Wood Utilization and the Forest Products Laboratory. The following information concerning the various types of connectors that are most adaptable to railroad construction is abstracted from the bulletin.

Modern connectors are devices for increasing the efficiency of timber joints. They consist in general of metal rings or plates or wood disks which, when embedded partly in each member, transmit load from one structural wood member to another. The wood members are kept from spreading apart by a bolt that is run through the centers of the connectors, and in some cases is employed to force the connectors into the faces of the timbers. In other cases a special squeezer is applied for this purpose. The connectors that have been developed to date in this country and in Europe may be classified broadly as follows: (1) Plates with teeth, spikes or corrugations that are forced into the faces of the wood members to be joined; (2) plain rings that fit into precut grooves in the wood members, or toothed rings that are forced in; and (3) disks, usually tapered each way from the middle, that fit into precut holes, half in one member and half in the other. The connectors of the second class have had some application in this country, for example, in the pontoon bridge built by the Chicago, Milwaukee, St. Paul & Pacific a little more than a year ago at Wabasha, Minn. In this structure they served to transmit longitudinal shear between the timbers making up the bulk-heads of the pontoon.



Six Forms of Timber Connectors and the Manner of Their Use

Principle of Design

The design principle underlying the use of modern connectors is based on the fact that where the sole connector at a wood joint consists of a bolt, the stresses in the edge of the wood around the bolt are relatively high, and it was to relieve these high edge stresses that short, simple metal or wood bushings were first inserted

around the bolt at the faces of the member to increase the bearing area. From these simple connectors were developed the modern rings, toothed plates, doubly-tapered disks and other more elaborate devices.

Other advantages of the modern connectors are that through their use a larger percentage of the gross cross-sectional area of a structural-wood member can be developed at the joint than with former joining methods; that the various connectors lend themselves to the use of boards and planks in built-up members, replacing heavy solid timbers; and, that while a number of bolts might have been used to transmit a load equal to that carried by these connectors, the total weight of the connectors will be considerably less than that of the bolts. Furthermore, timber construction that is joined with modern connectors is adapted to preframing and prefabrication.

Although information was assembled regarding a large variety of connectors, only a few of the more promising, as applied to American woods, were submitted to tests. The bulletin is divided into a discussion of three general types as follows: (1) Cast or punched plate dowels; (2) ring dowels; and (3) disk and coned dowels. Of the first type, the Siemens-Bauunion (or S. B. U.) hinge connector, the bulldog connector, a friction plate and the G. S. spike connector were submitted to tests; of the second type the Alligator connector and the Locher split-ring dowels were tested; while of the third type the Kübler doubly coned dowel was submitted to tests.

The Siemens-Bauunion Connector

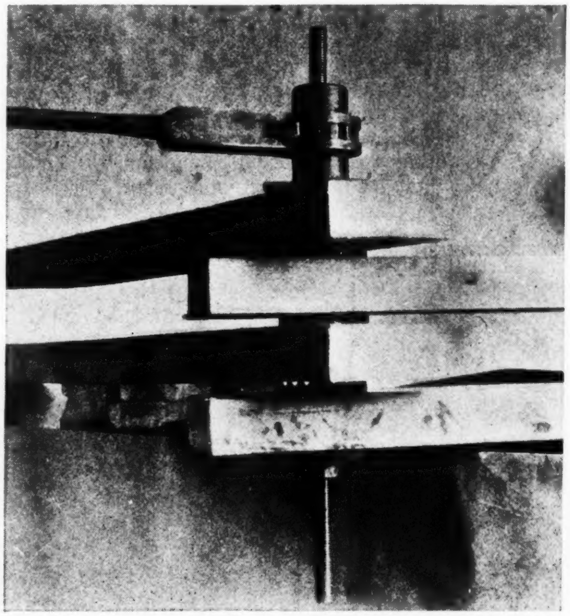
The Siemens-Bauunion connector, which was introduced in 1926, is especially suitable for joining solid timbers, and stresses the wood only in the direction in which it is strongest, that is, parallel with the grain. As shown in the drawing it consists of a heavy steel ring into which two or more straps of silicon steel are fitted and locked in place by a mushroom-shaped steel locking wedge. Circular claw plates of cast iron, 3⅛ in. in diameter, are bolted to the straps and pressed into the wood on both faces, transmitting both compression and tension from the wood members to the steel straps. The metal ring, because of the high stresses to which it may be subjected, is made of special steel and is heat-treated to avoid rupture near the breaking load. These connectors are always used in pairs on the opposite sides of timber and as all forces meet at the hinge no secondary bending moments are induced in the members. The safe load that the Forest Products Laboratory recommends for a pair of these connectors in seasoned timbers is 6,400 lb.

The Bulldog plate connector was introduced into this country several years ago and has been used in a number of important structures. It consists of a steel plate, circular, square or oval in shape, with teeth spaced evenly along the edges at an angle of 100 deg. with the plate. The joint is formed by placing the connector between two wood members, after which they are forced together and held in place by a bolt inserted through the center of the connector. The Bulldog connector is made in six sizes, five with teeth on both faces and the sixth with teeth on only one face. Some of the larger sizes have teeth around the inside opening as well as around the outer edge.

This connector has been adopted for special use on railway bridges as a tie-spacer between the tops of the bridge ties and the bottoms of the wood guard rails, thus eliminating the necessity for dapping the guard rail to receive the ties. In this design the metal is thicker than that used in the Bulldog timber joint connector. All the teeth on each face are parallel with each other, although those on opposite faces are in perpendicular planes. This arrangement permits the insertion of the plate between the tie and the guard timber so that the teeth of the plate will be parallel with the grain of the wood in both members. According to service records this type of tie spacer evidently develops sufficient strength for its intended purpose.

G. S. Spike Connector

Somewhat similar in principle to the Bulldog connector is the G. S. spike connector, the initials being those of Gösta Smitt, who obtained the first patent on this connector in Sweden in 1918. The original G. S. spike connector was a casting consisting of 16 doubled-ended four-sided spikes arranged in the form of a square and held together by connecting members that formed an integral part of the casting. In assembling



Ratchet-Type Clamp Used to Press Connectors Into the Timbers

a joint using G. S. connectors, a bolt hole is drilled, the spike plates are inserted and then the bolt, well oiled, is drawn up tight, forcing the spikes into the wood.

In its tests, the Forest Products Laboratory used a circular variation of the G. S. square connector, which was 4 5/16 in. in diameter, with teeth having a total length of 1 1/16 in. Twelve arms extended radially from a central circular plate, about 2 in. in diameter, to a ring with a tooth at each end of each arm on both faces. The G. S. spike connector has been employed in the construction of a number of important structures in several European countries.

The Alligator connector, which was patented by Johansson & Solberg, Oslo, Norway, in 1921, is the most important of the toothed ring connectors. It consists of a circular band of low-carbon steel about 1/16 in. thick, cold-rolled, stamped and bent to shape. The metal is cut so as to form triangular teeth having a convex outer surface to increase their holding power. The rings are light and cause only a slight decrease in the cross-section of the wood, even though some of the

teeth are perpendicular to the grain. When used to join woods of unequal hardness, the Alligator rings will have a tendency to penetrate into the softer wood farther than into the harder piece, thus developing a more nearly equal load-bearing capacity in each member. Moreover, a toothed dowel such as the Alligator ring, will tend to restrict any incipient splitting or checking of the wood in much the same way as do the irons that are driven into the ends of ties.

The Alligator ring is made in several sizes and in two series, one with ¾-in. teeth and the other with 1-in. teeth. Recognizing the greater hardness of some American woods as compared with European woods, the manufacturer is now developing a slightly modified and stronger Alligator ring that will permit easier assembly and should reduce the tendency of the ring to buckle and twist under load.

Split Ring Connectors

The Locher split-ring dowel, which is one of the more commercial types of connectors, is manufactured in two types—the integral ring and the two-piece or Bipartite ring. Ring connectors, or dowels, in general, may be likened to a short piece of iron pipe that is embedded for half its length in one member and half in the adjoining piece, with a bolt through the pipe to hold the assembly together. Ordinarily circular grooves to receive the rings are cut into the faces of the wood members by motor-driven boring machines. The original ring dowels consisted of solid steel castings but later modifications, such as the Locher rings, were split in much the same manner as a piston ring, as it was recognized that split ring dowels had certain well-defined advantages as compared with the closed or solid type.

Both types of Locher rings are of the same shape, being thicker at the middle than at the edges, the inner surface of the ring tapering uniformly to each edge. The thickening of the ring at its middle is for the purpose of insuring a good initial bearing against both sides of the groove, and also increases the resistance of the ring against distortion. The split in the rings is inclined at an angle of about 35 deg. in order to provide end surfaces that will bear on each other for an appreciable distance so that the ring will adjust itself readily to shrinkage without damage to the wood walls of the groove. The Locher integral ring consists of one piece while the two-piece or Bipartite ring has an S-shaped hinged joint opposite the split. This joint was introduced following recognition of the fact that an ordinary split ring, when adjusting itself to bear against both the inner core and the outer wall of the groove was sometimes stressed rather highly in the section opposite the split.

The Kuebler Dowel

Disk and doubly-coned dowels, which are solid except for the bolt hole, fit into bored holes instead of grooves and taper each way from the middle. In shape they resemble the object that would be formed by fastening together the frustums of two cones at their bases. The Kuebler dowel, which is probably the best known of the disk and coned type, has been used with marked success in many important structures in Europe. Originally this connector was manufactured of cast iron but since 1927 oak wood has been used almost exclusively in its manufacture.

For several reasons modern connectors are readily adaptable to the use of treated timber. As stated previously, the preframing of timber structures joined with connectors is already an accepted practice and, since the preframing of treated timber is a common practice on the railroads of this country, the railroads should encounter no obstacles in this direction in the application of connectors in their structures. When using modern connectors in connection with treated timber, preframing is desirable because many of the connectors penetrate nearly ¾ in. into the wood, which may be deeper than the penetration of a preservative.

Eliminating the Hazard*

By P. G. LANG, JR.
Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

NO form of bridge work, whether it be the erection of a new structure or repairs to one already in service, involves so many hazards to non-employees as that connected with structures spanning public thoroughfares. For this reason, it is essential that all work on such bridges be so prosecuted as to insure absolute safety to and minimum interference with both highway and railway traffic.

In some cases, the nature of the work may require at least the temporary diversion or cessation of one or both classes of traffic. Where roadway movement is discontinued, a substantial barricade should be erected across the highway on each side of the site of the work. Brief, legible and intelligible warning signs should be attached to the barricades, and at night they should be illuminated with red lights. As a measure of added precaution, it is also advisable that supplementary signs and at night red lights, be posted conspicuously beside the road at least 150 ft. in advance of each barricade.

Should Provide Signs for Detours

Where a section of the highway is closed, a detour is usually provided. Suitable signs should be placed at the intersections of the detour with the highway affected and along the route of the detour for the information of travelers using the road. In rural districts, an adequate number of watchmen should be employed to warn travelers of the obstructions and direct them around the affected point. In metropolitan areas, a definite working arrangement should be concluded with the local police department, and the protective measures devised on the basis of its advice or instructions. Care should be taken to insure that the detour is at all times maintained in a safe condition for the classes of vehicular traffic that may reasonably be expected at the point under consideration, and the duration of this expedient for handling the traffic should be held to the absolute minimum consistent with the needs of the work.

On important public thoroughfares, whether highways or city streets, the interruption of traffic is attended by a measure of inconvenience which is proportional to the volume of travel. At such intersections, a continuance of this traffic is of such importance that methods which will avoid its interruption merit a corresponding degree of attention in formulating the working schedule. In devising means to provide for the full and uninterrupted use of the highway, certain require-

*This discussion was submitted for publication in the What's the Answer department, but because of its scope, it is presented here as an independent article. For further discussion of this subject, see page 293.

ments of the work itself should not be overlooked, or their relation to the problem of avoiding interference with or interruption of the traffic on the thoroughfare.

Precautions That Are Important

Among these, storage sites for material, plant and equipment for use on the project should be selected so as to avoid or minimize obstruction to the highway. Where the operations on the bridge require the use of falsework, it is usually practicable to design this temporary support so as to provide sufficient clear opening for the accommodation of at least one lane of traffic. The exigencies of the work may require that the position of this opening be shifted during its progress. In such cases, it is usually equally practicable to provide for the necessary changes in the falsework when the method of procedure is planned.

A wood or metal canopy, a board platform or some other suitable protection should be maintained below the bridge to prevent injury to travelers on the highway as a result of dropping paint, tools, rivets or other objects. Where it is necessary to restrict the movement of highway traffic to one section or lane of the roadway, special vigilance and care should be exercised to insure that the part of the road that is available for the movement of traffic is in proper condition to discharge its function.

Instructions should be issued to the personnel engaged on the work that encroachments upon the highway clearances, other than those contemplated in the plans and method of procedure, and agreed on with the public authorities, are to be made only in cases of unavoidable necessity, and that when necessary their duration shall be restricted to the absolute minimum. Advance notice of such special encroachments and their expected duration must in each case be given to the watchman guarding the highway. This category includes the placing of ladders in the roadway for the purpose of reaching otherwise inaccessible points.

Warning Signs Are Needed

Warning signs should always be placed on each side of the crossing to apprise the public that such work is in progress, regardless of whether the highway clearances are restricted. Where clearances are restricted, the warning signs should so state. At night, both the lateral and vertical clearance lines of the traffic opening should be outlined or otherwise indicated by red lights. "Night" as used in this connection should be understood to mean the period between sunset and sunrise.

Whenever it becomes necessary to shift telegraph, telephone, power or other wire lines in connection with the performance of such work, they should be disposed of in such a manner as to insure that no user of the highway will be injured as a result of the change, and that they will not interfere in any way with trains, derrick or stationary hoisting equipment, other power machines or the workmen in the discharge of their duties.

Under all circumstances where work is pursued at crossings of the character under consideration, an adequate number of watchmen should be provided properly to protect highway movements, inform approaching travelers of the conditions ahead and direct them through the affected area. The problems arising in connection with this phase of the matter are usually susceptible of the most satisfactory solution when developed in conjunction with the public authorities having jurisdiction over the street or highway involved.

Work on bridges which cross streets obviously involves questions of public safety and in connection therewith it should be recognized that it is the duty of public officers to exercise a measure of authority and assume a share of the responsibility. It makes no difference whether the work is situated in an urban or a rural community, for in either case an intimate and friendly understanding and co-operation should exist between the representatives of the railway and of the community in which the work is being done.

Co-operation of the Police

Almost invariably the attitude of city, state-highway and police departments is that of friendly co-operation in devising measures for the protection and control of the public. Their services are furnished without cost to the railway and are of definite value in protecting its property and interests as well as promoting the safety of the public. The police employed in connection with operations of the character under consideration, whether members of the railway, the state or the county organization should be in uniform, as the city police are, since this distinctive mark and symbol of their authority is of material value in controlling the public.

Movements of large railway-bridge spans are rare as they are usually spectacular and generally receive considerable advance publicity in the local press, so that they almost invariably attract a large gathering. The handling and erection of such spans are deemed to have an educational value and not infrequently recess is declared at adjacent schools to permit the pupils to see the operation. The impression produced upon the minds of persons who see such an operation proceed harmoniously and successfully to a conclusion is not without advertising value to the railway. In handling the crowds which are wont to assemble on such occasions, the attitude of the railway should be friendly to the public and its representatives. Their measures should be formulated to the end that every observer may derive the maximum pleasure and instruction from his experience, and that none incurs any risk of injury.

Serious Consequences May Result

As an instance of the serious consequences which may result from failure scrupulously to guard every phase of the work on railway bridges over public thoroughfares, the following is quoted from a routine daily report of an incident which occurred not many years ago on a project of this character, which was in progress on the outskirts of a large midwestern city:

> A one-horse wagon belonging to the * * * * Gas Company, driven at a rapid rate by W. B., headed south, at 3:25 p. m. today passed under paint scaffolds which were 12 ft. in the clear. The wagon had a ladder rigged on it, which should have been down. The driver was flagged by the watchman but failed to heed the signal. As a result he pulled down three scaffolds and an apprentice was thrown to the street, striking an automobile which was following the wagon. The apprentice's heel went through the top of the automobile and three buckets of paint fell on the car. One head light was broken and the other bent. The car contained a bridal couple and party, all of whom escaped unhurt. The gas company today assumed all blame and settled for the car and with the contractors for their damages.

Who can contemplate a bridal trousseau in an unexpected shower of black bridge paint without resolving that he will by all means at his disposal seek to avert the recurrence of such a catastrophe!

Tie Producers Study Supply and Demand

Convention at Richmond, Va., urges practices in buying that will improve deliveries—Discusses standardization of boring and adzing

FACTORS affecting the supply and demand for crossties were the chief topics of discussion at the convention of the Railway Tie Association, formerly the National Association of Railroad Tie Producers, at Richmond, Va., on May 10 and 11. Future requirements were analyzed in papers by Dr. Julius H. Parmalee, director of the Bureau of Railway Economics, Washington, D. C., and by R. S. Belcher, manager of treating plants, Atchison, Topeka & Santa Fe System, and president of the American Wood-Preservers' Association. J. J. Schafley, president of the Potosi Tie & Timber Company, St. Louis, Mo., reviewed the effects of extreme fluctuations in demand on the cost of production and the adequacy of supplies, and a committee report outlined the problems imposed on the producer by variations between the demand for various sizes and their normal production.

Probably the most perplexing development discussed at the meeting was the adverse effect of the growing practice of adzing and boring ties prior to treatment on the accumulation of stocks by tie producers in advance of orders. Of a more technical nature was a paper by R. R. Poux, chief treatment inspector, Erie, on the Splitting of Ties. D. C. Curtis, chief purchasing officer, Chicago, Milwaukee, St. Paul & Pacific, presented a paper on What the Buyer of Ties Expects from the Seller.

The attendance at the convention approximated one hundred, including a considerable number of railway maintenance and purchasing officers. In the election of officers, S. S. Watkins, vice-president of the Joyce-Watkins Company, Chicago, who presided at the meeting, was succeeded as president by B. N. Johnson, B. Johnson & Son, Richmond, Ind., while R. M. Edmonds, secretary, St. Louis, Mo., was re-elected to that position. S. D. Hicks, vice-president of the Southern Wood-Preserving Company, Pittsburgh, Pa., and E. J. Stocking, sales manager, Hobbs-Western Company, St. Louis, Mo., were elected first and second vice-president, respectively.

Abstracts of papers and reports of interest to readers of *Railway Engineering and Maintenance* follow:

Is Standard Boring for Ties Practicable?

The urgent necessity of standardization in the boring and adzing of ties was stressed in a report prepared by a committee consisting of W. J. Burton, assistant to chief engineer, Missouri Pacific; W. H. Penfield, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific; and Ed Kelly, sales engineer, Greenlee Brothers. According to the report, the adoption of standard specifications for ties and their preservative treatment went a long way towards enabling the producer to get out ties between the seasons of active purchasing because he knew that if his ties met the specifications he could find a buyer and that if treatment became necessary before the ties were sold, he could give them a standard treatment and still be reasonably sure of a seal.

However, a serious complication has been introduced by the growing practice of adzing and boring ties before treatment because of the wide variations in the arrangement and spacing of spike holes. Replies to questionnaires sent to railroads whose ties are adzed and bored prior to treatment show an almost complete lack of agreement in the specified dimensions, even for the same rail sections, tie plates, cant, etc. With respect to the length of the tie, the positions of the holes depend upon the gage (usually standard), width of the rail base, width of the rail head at the gage line, height of the rail if canted, cant of tie plates if any, diameter of the spike, shape of the spike at the throat and the clearance allowed for, if any. With respect to the width of the tie, the positions depend upon the design of the rail joint and the necessity of keeping spikes away from the nut end of track bolts. The size of the hole depends upon the size of the spike and the kind of wood, but variations in the size of the hole are relatively unimportant.

The committee concluded its report with the recommendation that the Railway Tie Association suggests to the American Railway Engineering Association that it give consideration to an effort to standardization of track which would effect a corresponding standardization of adzing and boring.

Utilizing Various Tie Sizes

A COMMITTEE, of which A. R. Fathman, vice-president, Hobbs-Western Company, was chairman, reported on the economy of utilizing tie sizes in proportions normal to run-of-woods production. In its report, the committee started from the premise that timber conservation required the use of the various sizes of ties that may be most readily and naturally made from the tree and that can be economically applied to the various conditions of track service. A study of five million

ties produced and sold during 1928 by several of the larger tie companies, disclosed the following distribution of sizes:

Production	Tie Size	Sales
28.2 per cent	No. 5	28.5 per cent
9.2 per cent	No. 4	8.5 per cent
39.7 per cent	No. 3	43.2 per cent
12.8 per cent	No. 2	10.0 per cent
10.1 per cent	No. 1	9.8 per cent
100 per cent		100 per cent

The following percentages are based on figures furnished by several railroads in producing territories, for 1928, covering purchases on their own lines of approximately five million ties:

No. 5	34.3 per cent
No. 4	9.6 per cent
No. 3	34.5 per cent
No. 2	11.6 per cent
No. 1	5.7 per cent
S.R.	4.3 per cent
	100 per cent

The committee reported instances where ties were purchased as follows:

No. 5—None
No. 4—A large proportion
No. 3—Small proportion
No. 2—A large proportion
No. 1—Very small proportion

Such a specification immediately sets up a producing handicap, as it runs counter to the normal woods-run production. Thus, any purchaser who buys all No. 4 and no No. 5 ties to come from any established producing territory in the middle west, can reasonably anticipate that the figures upon which his price is based are predicated upon delivering as large a number of Grade 5 as Grade 4.

Railroads that purchase only sizes 5 and 4, or ties 7 in. thick can, however, help themselves if their requisitions are as nearly as possible 80 per cent No. 5 and 20 per cent No. 4. Likewise, those railroads using sizes 3, 2, and 1, or ties 6 in. thick, will help the tie producer fill his orders more easily and, therefore, more economically, by buying the various sizes as nearly as practical in the following percentages: 75 per cent No. 3, 15 per cent No. 2, and 10 per cent No. 1. Those railroads which use all sizes, should base their purchases on approximately the following percentages:

30 per cent—No. 5
10 per cent—No. 4
40 per cent—No. 3
10 per cent—No. 2
10 per cent—No. 1

Excerpts from the Discussion

C. F. Ford, supervisor, tie and timber department, Rock Island Lines, called attention to the fact that the committee's figures showed that the buyers required 175,000 more grade 3 ties than were produced, requiring the manufacturer to draw on reserve stocks and also that the buyers did not accept the normal production of grades 1 and 2 by 155,000 ties, throwing the year's sales out of balance to the extent of 330,000 ties, or 6.6 per cent. Mr. Ford referred also to such special demands for ties as arise in the construction of yard or side tracks which affect a railway's purchasing program and make difficult the balancing of its requirements to conform to run-of-woods production.

C. C. Warne, assistant purchasing agent, New York Central, advocated that each road buy those sizes which best meet its needs, and defined the function of the producer to be that of developing outlets for the less popular sizes. W. J. Burton, assistant to chief engineer, Missouri Pacific, added that a proper adjustment of prices for the different grades afforded a means for the disposition of the slower moving grades. According to John Foley, forester, Pennsylvania System, the proportions of the various sizes presented in the report were not typical of eastern production, and they will vary with the rigidity of the inspection. He urged the committee to collect similar statistics in other areas for comparison.

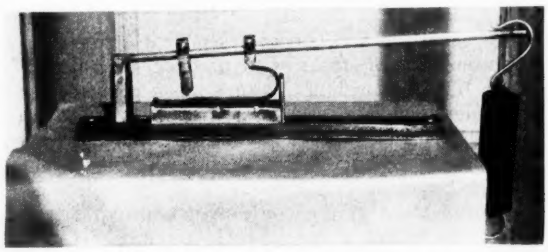
Keeping Ties from Splitting

By R. R. POUX

Chief Treatment Inspector, Erie, Cleveland, Ohio

THE TWO items of major importance in the storing of ties are (1) proper stacking to prevent decay, including proper yard sanitation, and (2) proper stacking and other methods to prevent the excessive checking or splitting of ties. The most effective methods of stacking ties to prevent premature decay have been fairly well established, the usual method being to stack the ties on creosoted stringers in the familiar arrangement of nine ties in a row with a transverse stringer at one end for each layer. When this method is used, the stacks are generally made about 14 tiers high, the ties in each row being spaced in such a manner as to allow sufficient air circulation. The tie stacks should also be so arranged as to permit the proper circulation of air around and through them. The storage yard must be well drained and kept free of vegetation.

The methods of stacking ties, the types of anti-checking devices used, the manner in which such devices are applied, the locality of the seasoning yard, the time of year in which the ties are cut, the size of the tree, the method of manufacturing the tie and the specie of wood all have important bearing on the rate and amount of checking to which the tie is susceptible. Because of this relatively large number of factors, opinion regarding the best methods of retarding checking is considerably diversified.



A Device for Testing S-Irons

Application of Anti-Checking Devices

Anti-checking irons should be driven as soon as possible after the arrival of the ties at the treating plant. The importance of early application of the irons is shown by a study in which it was found that in a lot of ties in which the irons were driven within three weeks after the arrival of the ties, splits developed in only 0.5 per cent of the total, whereas splits developed in three per cent of the ties in a similar group in which the irons were driven 60 to 90 days after arrival.

The driving of anti-checking devices should be done by experienced men who have been taught to so locate the irons as to make them most efficient. Where there is no check apparent in the end of the tie, the long axis of

the device is placed parallel with the tie faces and somewhat nearer the bearing face, i. e., the face with the greatest sapwood content, than the opposite face. Where checks have started, the long axis of the iron should be driven at right angles to the check as nearly as this is possible. C-irons should not be driven nearer than ½ in. to the faces or edges of the tie. In order to avoid splitting the ties, irons should not be driven when the temperature is lower than about 15 deg. above zero.

Effect of Stacking on Splitting

In stacking ties the method described above is usually considered most effective in preventing decay infection. Using this method of stacking, it was found in a study of several hundred piles that four per cent of the ties in the upper one-third, two per cent in the middle third and one per cent in the bottom third of the pile showed splits. This study also revealed that four per cent of the tie ends facing the prevailing winds and two per cent of the opposite ends contained splits. The percentage of splits increases with the age of the ties, emphasizing the importance of treating them as soon as they have lost sufficient moisture to permit the proper injection of the preservative.

For many years the lumber industry has made use of various types of end coatings on lumber to retard the checking. A recent inspection of approximately 35,000 gum ties painted on both ends with a creosote-tar solution and also driven with S-irons at both ends showed that splitting and checking were considerably retarded by the end coatings, in comparison with about 5,000 ties which were supplied with S-irons but not painted. It is quite possible, therefore, that future specifications will require the end coating of gum ties and the application of anti-checking irons only in ties that show incipient splits. The cost of coating the ends of ties, including labor and material, has not been determined but it will be considerably less than the cost of applying anti-checking irons at all tie ends.

Tests are also being conducted on oak and hardwood ties, using end coatings alone, combinations of end coatings and anti-checking irons, and anti-checking irons only. Results of these tests are not yet available but the indications are that the use of end coatings will be of assistance in retarding the splitting of these ties.

The Future Trend of Tie Renewals

TWO papers presented at the convention comprised analyses of the future trend of tie renewals. One of these, by Dr. Julius H. Parmalee, director of the Bureau of Railway Economics, Washington, D. C., approached the problem from the standpoint of the statistician; the other, by R. S. Belcher, manager of treating plants, Atchison, Topeka & Santa Fe System, reflected the results of his own observations and his contact with the industry through the American Wood-Preserver's Association, of which he is now president.

Mr. Belcher's Conclusions

According to Mr. Belcher, tie purchases of the past year or two indicate that the "bottom has been reached," and that total tie purchases will increase during the next few years. In round figures, there are 1,250,000,000 ties in the tracks of the railways of the United States. If all of these ties—treated and untreated—had an average life of 27 years, the annual requirements for replacements would be about 46,000,000, the amount of the 1931 purchases. Since our experience indicates that 27 years is much too long an average life for all ties, treated and untreated, in all tracks, it follows that the 1931 tie purchases are much lower than can continue for more than a year or two. In like manner, the 86,000,000 ties purchased in 1929 indicate a 14½ year average life of all ties in all tracks, which is more in accordance with what our experience has taught us to expect from a mixture of treated and untreated ties of all kinds and under a great variety of conditions. If by the replacement of untreated ties with treated ties, the average life is brought up to 20 years, requirements will fall to 63,000,000, but it will be some years before a 20-year life will be reached.

Balancing Supply and Demand

By DR. JULIUS H. PARMALEE

Director, Bureau of Railway Economics, Washington, D. C.

AT THE end of 1932, approximately 1,065,000,000 crossties were supporting 357,250 miles of tracks, owned and operated by Class I steam railways in the United States. About 72 per cent of this number, or a total of 770,000,000 ties, represented new crossties laid during the preceding 10 years, of which 715,000,000 ties had been laid in replacement and about 55,000,000 ties in new lines and extensions. A negligible number of second-hand and other-than-wood ties were also laid during the period.

Two-thirds of the new ties laid during these 10 years from 1923 to 1932, inclusive, were treated, while one-third were untreated. The proportion of treated ties increased from 49.6 per cent in 1923 to a peak of 79.1 per cent in 1929, then declining slightly to 78.5 per cent in 1930, to 77.4 per cent in 1931, and to 75.2 per cent in 1932.

Annual installations of crossties have steadily declined since 1923. The downward curve since 1929 has been particularly marked. The total number of treated and untreated crossties laid in replacement each year from 1923 to 1932 by Class I railways are given in the table. Comparing 1932 against 1923, tie replacements declined 53.4 per cent. Comparing 1932 with 1929, the decrease was 47.6 per cent. Every year since 1923 has shown a reduction in tie replacements under the next preceding year. The relatively large declines in 1930, 1931 and 1932 are explained by economic conditions. Even so, it is probable that if conditions in those years had remained as they were in 1929, there would still have been a reduction in the number of crosstie replacements. This is

Ties Placed in Renewals, Class I Railways, 1923-32

Year	Treated and Untreated Ties	Replacements in Percentage of Ties in Track
1923	83,987,983	8.3 per cent
1924	83,069,699	8.1 per cent
1925	82,713,452	8.0 per cent
1926	80,742,368	7.8 per cent
1927	78,323,046	7.5 per cent
1928	77,349,217	7.3 per cent
1929	74,662,278	7.0 per cent
1930	63,338,798	5.9 per cent
1931	51,486,627	4.8 per cent
1932	39,149,315	3.7 per cent
Total—10 years	714,822,783	

indicated by the trend from 1923 to 1932, as shown in the last column of the table, in which the replacements are in terms of percentages of the total number of existing ties in track, the trend being steadily downward.

During the seven-year period from 1923 to 1929, inclusive, 561,000,000 new crossties were laid in replacement. This represented 55.6 per cent of all ties in service as of the beginning of the year 1923, an average replacement of 7.94 per cent per year. However, the trend of replacements from 1923 to 1929 was downward, each year averaging about 0.2 per cent less of the total than the preceding year. If this slightly declining trend had continued after 1929, aggregate renewals beginning with 1923 would have equalled the total number of ties in track at about the end of the year 1936.

On the basis of the trend of replacements from 1923 to 1929, the total unexpired service life of ties in tracks at the beginning of 1923 was 7,210,000,000 tie-years, or 7.15 years per tie. During the seven years ended with 1929, 7,063,000,000 tie-years were consumed, leaving a balance of 147,000,000 tie-years. To this must be added, of course, tie-years represented by new ties placed in service during the period. Computing this at the rate of 20 years per treated tie and 7 years per untreated tie, the aggregate unexpired service life of ties in tracks at the end of 1929 was about 8,845,000,000 tie-years, or 8.77 years per tie. By the end of 1932, 3,027,000,000 tie-years of this amount were consumed, leaving a balance of 5,818,000,000 unexpired tie-years. Replacements represented 2,625,000,000 tie-years, making the aggregate unexpired service life of ties in track at end of 1932 about 8,636,000,000 tie-years of 8.36 years per tie.

Summarizing this rather complicated procedure, it appears that at the beginning of 1923, the unexpired service life of all ties in track averaged 7.15 years per tie. By the end of 1929, this average was increased to 8.77 years per tie, while by the end of 1932, because of a slackening in tie renewals, the average dropped to 8.36 years per tie.

In the foregoing computations, I have not included new ties laid in additional tracks, new lines and extensions. Approximately 55,000,000 ties were installed in work of that character during the last 10 years. These ties would tend slightly to increase the average tie life, and I think we can safely estimate the unexpired service life of all crossties now in railway tracks at an average of about 8½ years per tie, or an aggregate of 9,053,000,000 tie-years.

Future Consumption

In other words, existing ties will be consumed in that period on the average, and aggregate replacements in the next 8½ years would be equivalent to the total number now in track. This will mean the purchase during the next 8½ years of approximately 450,000,000 crossties of an average service life of 20 years per tie. Considering the fact that the average service life of ties being put in tracks at the present time is somewhat less than 20 years per tie, it seems reasonable to calculate that the carriers may require as many as 60,000,000 crossties annually, to maintain recent standards of tie renewals.

To replace 60,000,000 ties, therefore, would amount to an aggregate expenditure which under present conditions would be more than twice as much as the roads are now spending for tie renewals. The carriers renewed 39,150,000 crossties in 1932. Present indications are that fewer than 30,000,000 ties will be renewed in 1933, inasmuch as maintenance of way and structures expenses in the first quarter of 1933 were reduced 25 per cent under the corresponding quarter of 1932. This reduction was reflected, among other things, in a considerable decline in tie renewal expenditures.

There is a definite relationship between traffic and tie-budgeting, and that is the effect of the volume of traffic on the life of ties. I recently reviewed a study prepared during the days of federal control by a special maintenance committee, to ascertain whether "difference in use" has a measurable effect on maintenance of way expenditures. For total maintenance of way expenses, the committee found that approximately 33 per cent is affected by traffic. With regard to tie expenses, the committee's opinion was that 30 per cent of the expense is affected by traffic. Whatever the extent of that influence may be, this should be considered in outlining and balancing any budget of future tie demands. Under normal conditions, the volume of traffic has probably a less effect on the tie program than other factors. When traffic drops to such levels that expenses must be cut to the bone, as at present, then the usual standards are suspended and the absence of traffic becomes the controlling factor.

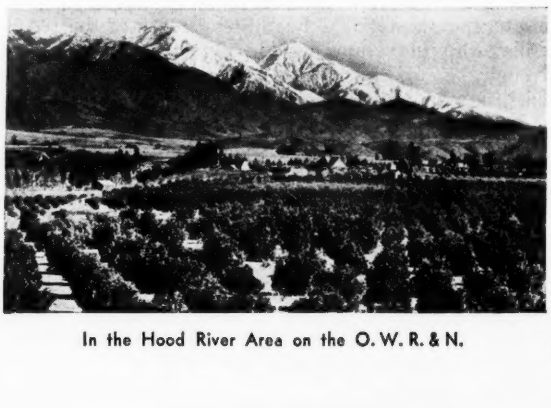
Is Weed Killing Worth While?

(Continued from page 280)

fact that they are the result of diverse conditions of climate, soil, character of vegetation and length of growing season. A railway officer in the Middle West is meeting conditions different from those in the arid Southwest. Roads along the Gulf Coast may be fighting weeds, while the Canadian roads are still fighting snow. And an officer whose greatest difficulty comes from fox tail, horse tail or joint grass, does not have the same viewpoint as one who must eradicate Johnson or Bermuda grass from the ballast section and roadbed.

Despite these differences, it is evident from the expressions which have been given that without exception railway maintenance, operating and executive officers have found that weed killing is worth while, primarily from the standpoint of improved roadbed and ballast conditions, and that many of them are assured that weed destruction is economically justified by the decreased labor for track maintenance which results from this practice. The replies to the questionnaire indicate rather wide differences of opinion as to the relative effectiveness of the several methods of weed control that are available, although several officers said rather pointedly that they were on the lookout for better and more economical methods than they are now using.

The answers also show that those who contributed to the discussion are fully aware that they cannot obtain satisfactory physical results without destroying the weeds consistently and persistently year after year and that if they do so, the annual costs for this work will be considerably reduced. The weed nuisance is a matter of grave concern to railway officers, who will welcome any developments that will reduce the burden which it imposes on their time and the expenditures of the railways with which they are connected.



In the Hood River Area on the O. W. R. & N.

Moving a 40,000-Gal. Steel Tank Four Miles

IN THE consolidation of water stations on the Central region of the Canadian National, brought about by the increased capacity of engine tenders and longer engine runs, a number of water service tanks have been dismantled, moved and re-erected at other points. In one case, however, a 40,000-gal. steel tank was moved bodily, with its steel tower for a distance of four miles, without difficulty and at a marked reduction in the cost and delay which would have been involved in dismantling it. This method of moving tanks would have been resorted to in other instances if traffic and overhead and side clearances on the routes of movement had permitted. In these cases it was necessary to dismantle steel tanks, and sometimes wooden tubs, into sections of a size which could be handled on flat cars or gondolas, and then to reassemble the tanks at their new locations.

Steam Cranes Move Tank as a Unit

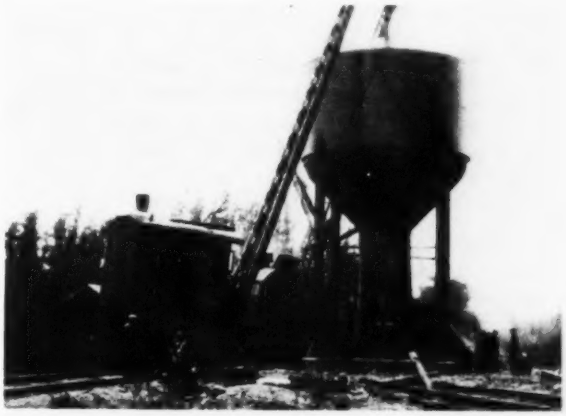
The tank which was moved as a unit was of the Horton conical-bottom type. This tank was located directly alongside the track at Bankfield, Ont., and was moved to a similar location at Keemle, four miles away, in single-track territory. Since there are no structures which limit either vertical or lateral clearances on this section of the line, no difficulty was experienced in this regard.

The move was made with two 25-ton steam-driven locomotive cranes, which picked up the tank between them and held it clear of the track while both of the cranes and the tank were moved as a unit in a work train to the point of reinstallation. In the first operation, the two cranes, facing each other, were located on opposite sides of the tank. Their booms, 50 ft. in length, were swung out at angles of approximately 35 deg. from the center line of the track, thus bringing

On the Road Between Bankfield and Keemle, Ont.

their tops directly opposite each other on the center line of the tank. Special slings of ⅞-in. cable were then attached to the tank and its tower supports so that it could be lifted as a unit with a considerable degree of stability. More specifically, the sling cables extended from the fall line at the top of each crane boom and encircled the tank drum on each side, were fastened to the tops of the tower legs on the sides opposite the cranes. This not only provided for an adequate lifting component on each cable but also a lateral component against the sides of the tank to prevent it from overturning. As a further precaution in this latter regard, steel struts were bolted between the bases of the tower columns, forming a rigid box-like structure, and cable ties were made between about the mid-point of the length of each crane boom and the bases of the two nearest tower columns.

Following the completion of these preparations, the bolted connections of the tower columns and downcommer to their foundations were broken by either removing the nuts of the bolt fastenings or by cutting the bolts with an acetylene torch. The tank was then ready to be lifted. The lift, which amounted to only



The Two 25-Ton Cranes Which Made the Move, Setting the Tank

about 12 in., was made gradually, with the cranes working in unison. Most of the load was carried by the high cables, the lower holds acting mainly as auxiliaries to insure stability and safety.

Four-Mile Move Made With Work Train

With the tank clear of its old foundations and at an elevation of about eight inches above the top of rail, the booms of the cranes were swung until the tank was suspended directly over the center line of the track. When in this position, with the lowest point of the tower columns and downcommer still about eight inches above the top of rail, the two cranes were made immovable with respect to the other by means of long timbers and chains, which acted as couplers. Lashed together in this manner, the cranes, with the tank between them, were pulled over the road in a work train at a speed of from four to five miles an hour.

At Keemle, where new concrete foundations had already been prepared to receive the tank, the operations were practically the reverse of those at Bankfield. The tank was first swung out over the new foundations, and was then lowered in place and bolted to the foundations sufficiently to permit release of the cranes. The foundation connections were then completed and the water connections made, the work being completed on the fifth day from its start.

All of this work was done by a bridge-erecting gang of eight men and a foreman, assisted by a couple of water service department men and, for one day, by the two cranes and work train with their crews. The total cost of the work, including labor and equipment charges, was approximately $950. The moving of the tank was planned and executed under the direction of T. T. Irving, and C. P. Disney, chief engineer and bridge engineer, respectively, of the Central region of the Canadian National, reporting to W. A. Kingsland, general manager.

What's the Answer?

Have you a question you would like to have someone answer?

Can you answer any of the questions listed in the box?

> ### To Be Answered in August
>
> 1. *From the standpoint of maintenance, what advantages, if any, are there in sodding slopes in cuts and on embankments? How can this best be accomplished?*
>
> 2. *Where fluctuations in a stream or reservoir are greater than the practicable suction lift, what means can be employed to insure a dependable delivery of power and continuity of pumping?*
>
> 3. *What period of the day is most suitable for lining tracks? Why?*
>
> 4. *When it becomes necessary to saw piles off under water to provide an even bearing for sills or other timbers, how can this best be done?*
>
> 5. *When giving the track a heavy raise, what is the maximum lift that should be permitted? Why?*
>
> 6. *What is the most satisfactory method of insulating the exterior walls of ice houses? How should the work be done? What precautions are required?*
>
> 7. *What are the relative advantages and disadvantages of laying rail in strings as compared with laying single rails? What precautions should be taken?*
>
> 8. *What special precautions are required when painting structural steel in hot weather?*

Chipping Rail Ends

What is the cause of chipping at the ends of rails? What can be done to eliminate or minimize this trouble ?

Poorly Fitting Joint Bars One Cause

By H. F. FIFIELD

Engineer Maintenance of Way, Boston & Maine, Boston, Mass.

Tight expansion, poorly fitting joint bars and the flowing of the rail metal are principal factors in causing chipped rail ends, but any condition, such as loose joint ties or angle bars, which allows the rail ends to move individually will cause the rail to chip as soon as the metal in the head begins to flow under traffic.

To remedy the trouble, joint bars should be kept tight and the track in good surface so that there will be no relative vertical movement between adjacent rail ends. Expansion should be maintained as closely as possible without the hitting of the rail ends, allowing for variations of temperature. Bevelling the rail ends, both at the top and sides of the head, will prevent chipping, provided the expansion is maintained to the proper width of gap by the application of sufficient anti-creepers. Heavy plates under joints tend to prevent chipping, but will not eliminate it entirely unless expansion is maintained properly.

Some of the Causes Are Obscure

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Apparently there are a number of causes for the chipping of rail ends, some of which are rather obscure. From a practical view point, however, it may be said that the principal cause is the flow of metal toward and over the end of the rail under the rolling action of the wheels. As long as there is an expansion gap the flow may continue with no effect so far as chipping is concerned. As the expansion gap closes under higher temperatures, however, the overflowed metal makes the first contact with the adjacent rail and as the movement of closing continues, this metal is sheared off to form a chipped place on the running surface. This condition may be aggravated, however, by many factors, including loose bolts, worn angle bars, poor joint surface, poor or loose joint ties and a variety of other defects in maintenance, including a lack of sufficient anti-creepers and an absence of joint tie plates.

What can be done to overcome the trouble? In part, the cause suggests the remedy. Rail joint maintenance should be to the highest practicable standard. This does not overcome all of the trouble, however; experience has shown that conditions can be definitely improved and that in many cases chipping can be practically eliminated by heat treating and bevelling the rail ends. We have several miles of rail that is heat treated at the ends which is giving excellent service under our heaviest traffic.

Improper Expansion Often the Basic Cause

By J. L. SOUTHARD

Assistant Cost Engineer, Chesapeake & Ohio, Columbus, Ohio

Most chipping at rail ends originates in the careless practice of not providing or not maintaining proper expansion. This may occur when the rail is laid or it may be due to an insufficient number of anti-creepers, particularly on stretches of track where the tendency to creep is excessive. In some cases, the proper amount

of expansion is provided in the first instance but cannot be maintained because of improper adjustment of the rail anchors.

Often, too little stress is placed on the use of expansion shims of different thickness to correspond to temperature changes during the laying of the rail. On the division to which I am assigned, rail is usually laid during the fall and winter, the standard expansion being $\frac{3}{16}$ in. for the temperature range between 30 and 60 deg. F. At first, a metal shim was used, but later a fibre shim was substituted, owing to the introduction of slotting and heat treating of the rail ends, which have combined to minimize chipping at the ends. Where metal has flowed over the rail end, the ends are cross-ground and then heat treated for the full width of the head for about two inches back of the end. When rail is laid, this treatment is completed before trains are allowed to pass over the rail.

From experience, we find that when proper methods are used to avoid brittleness and decarburization, and when the ends of the rails are bevelled, chipping is not only minimized but in many instances practically eliminated.

[Discussions of this subject were also received from Charles E. Sandoval, section foreman, Southern Pacific; Henry Becker, section foreman, St. Louis-San Francisco; W. E. Tillett, assistant foreman, Chesapeake & Ohio; H. E. Herington, section foreman, Minneapolis & St. Louis; and E. Lane, extra gang foreman, Missouri Pacific. These replies were unanimous that improper expansion and poor joint maintenance are responsible in part for chipping at the ends of rails, and that first class maintenance will tend to minimize the trouble.—Editor]

▼ ▼ ▼

Filling High Trestles

When filling a high trestle, what practical methods can be employed to eliminate or minimize the sliding of the embankment after the work is completed ?

There Are Three Requisites for Prevention

By H. T. LIVINGSTON
Division Engineer, Chicago, Rock Island & Pacific, Little Rock, Ark.

There are three prime requisites if sliding embankments are to be prevented: (1) Suitable filling material, (2) proper placement and (3) proper maintenance until compacting is completed. The procurement of the proper material may present the greatest difficulty. Generally, a long haul is warranted if it is certain that the material so obtained will serve adequately. Quite often trestles are constructed to be filled later, because no material is available at the site suitable for making the high embankment. The height of the fill enters into the problem of whether chances should be taken on its becoming a menace when completed. I would estimate that the desirability of placing the best material obtainable varies directly with the height of the fill.

Proper placement, even with good material, is vital. The natural ground should have sufficient bearing power to support the superimposed weight. If it can be determined that the ground will not support the weight of the fill beyond normal subsidence, it should then be determined whether it is economically feasible to remove the surface material down to a stratum that will support the load. The new material should be placed in nearly horizontal layers from 1 to 4 ft. thick, keeping them a little higher at the center and sloping toward the sides to insure that no pockets will form as the fill gains in height or settlement occurs, which will be difficult to drain. All timbers, such as sash and sway bracing and any others not absolutely necessary for the safety of the structure should be removed as the fill progresses. Though seldom done, bent timbers, piling and caps should be pulled out to the maximum extent possible when the stringers are removed, as this will minimize the probability of water pockets and cleavage planes.

The topping material is one of the most important features of work of this character. It should shed water fairly well and be of sufficient depth to insure that water will not reach the earth fill. Certainly, porous materials, such as cinders, non-cementing gravel or similar substances, should not be used on top of new fills, since they tend to form a wedge which may eventually split the fill. Proper topping may vary in thickness; on low fills a foot or so may be sufficient; on fills 20 ft. or more in height a proper pre-ballast should be from 2 to 4 ft thick. In my experience, burned mine shale, which is produced in most bituminous coal mining sections, is the best topping material.

Cleavage Planes Should Be Broken

By GEORGE S. FANNING
Chief Engineer, Erie, Cleveland, Ohio

The sliding of embankments constructed by dumping from a high trestle results from the formation of cleavage planes of a conical shape with an angle greater than the angle of repose of the material under load. Such slides can be minimized by breaking up the dump and distributing the material in horizontal layers over the entire width of the fill. A modern machine which greatly helps in accomplishing this is the crawler-mounted bulldozer, which not only distributes the material in thin horizontal layers, but thoroughly compacts it by working over it.

It so happens that we are now engaged in filling a trestle opening. In this case the trestle is in the eastward main track, the westward track being on a fill some distance away. Having one track already on the fill permits us to single track at this point so that we have been able to remove the old trestle completely, and are making the fill with crawler-mounted wagons. The contractor who is doing this work was selected in preference to others who offered to do it at as good a price because he had crawler-mounted equipment, the normal movement of which serves to compact the fill in horizontal layers.

Slides Seldom Caused by Poor Foundation

By G. M. HELMIG
Track Supervisor, Missouri-Illinois, Bonne Terre, Mo.

Slides are seldom caused by poor foundation material, but by improper methods of construction, in which planes of cleavage are formed between successive layers of material. These may lie flatter than the angle of repose when the material is dry but be steeper than this angle when the material becomes wet. Again, the filling material may be of such a character that it readily absorbs water and collapses without regard to planes of cleavage when in this condition.

In many cases, where the foundation strata are suit-

able and a satisfactory earth is not readily available for filling, spalls and other quarry refuse are used to advantage. In some respects this material, where available, may be the most economical to use, since the trestle can be torn out as soon as the filling is completed, thus eliminating further maintenance.

Slides can be eliminated, first, by using a stable material for the filling; second, scarifying all slopes upon which the new filling is to be laid, and the natural ground if it slopes, or by constructing muck ditches parallel to the track on both sides of the bridge; by placing the filling in horizontal layers two feet or less in thickness which are thoroughly compacted before the next layer is applied; by using flatter side slopes than normal; and by applying a top fill which will not wedge itself into the underlying fill. The use of porous materials on top of a new fill will later cause trouble.

▼ ▼ ▼

Using the Spot Board

What are the advantages of the spot board in surfacing track? Can it be used for light surfacing? What are its limitations? What sequence should be followed and how should the jacks be placed when raising track with a spot board ?

Can Be Used for Any Lift

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

There are many advantages in the use of the spot board, the most important being that a smoother surface can be obtained through its use as compared with the ordinary method of sighting. There is less likelihood of forming "humps and hollows" where the spot board is used, or, if they are already there, they are more easily eliminated. It can be used for a light surface with the same facility as for a heavy lift.

From my experience, both as a member of and as foreman of surfacing gangs on several roads, I have found that three major points should be kept in mind when using the spot board. First, the jacks should never be allowed to get too near to the spot board before it is moved ahead; otherwise the board may be lifted when the track is raised, causing a hump in the track. Second, the sighting block should be kept well back of the jacks; never closer than half a rail length, and a full rail length is better. Third, all levels should be inspected carefully to insure that they are correct before the surfacing is started. A level that is out of order will invariably result in track that is out of level. It is just as important that the spot board be correctly leveled.

In making a raise, the jacks should be inserted between the second and third ties ahead of the joint. This will permit the renewal of the joint ties and give room for tamping them without interference from or with the jacks. The spot board should never be raised where there is an excess of ballast or lowered at slack places. It should be set to give the best or the most practicable surface and the ballast should be trucked as needed.

When starting to surface on grades, one should not sight to the mark on the spot board at once. It is better to count the lifts that are to be made between the jacks and the first setting of the board and divide the difference between the mark and the actual reading before the raise is made, by the number of lifts that are required. When the board is taken ahead, it is advisable to keep the sight blocks as they were, sighting over the last joint raised to observe how it comes out on the board. If this is not satisfactory, often a better surface can be obtained by shifting the board to set it on a high or a low spot. This is especially true where the surface is quite uneven or filled with humps and hollows. In practice, I find that better results can be obtained and there is less delay if the board is moved ahead five rail lengths at each setting.

Spot Board a Most Useful Tool

By District Engineer

I consider the spot board a most useful tool in surfacing, whether it is employed for making a light lift or for a heavy one as in ballasting. It is my experience that it facilitates the raising of the track and that foremen generally do better and smoother work where it is used. For light work or, in fact, any surfacing where it is not desired to set grade stakes, the foreman, often in conjunction with the supervisor, especially if the track is to be given a considerable raise, should go ahead and mark the points, generally high spots, where the spot board should be set up, together with the amount of lift that it is estimated the track should be given.

These setting-up points will seldom come at regular intervals, but, in general, should not be closer together than five rail lengths or farther apart than eight. Too short an interval tends to cause too frequent breaks in the grade line and thus an irregular surface; making the intervals too great often causes eye strain, particularly on very hot days, and tends toward inaccuracy of sighting, which will also result in irregular surface. This is a practice that is not often followed, but like other instances where careful preparation is made, the time involved in making the investigation and thinking out the procedure is time well spent. When done in this way, the setting-up is not done under pressure of other responsibilities and is, therefore, likely to give better results. It should be emphasized, however, that the lift markings thus made can seldom be followed rigidly. Some adjustments must be made at nearly every point, but this is usually a matter of only a moment or two. To move the spot board ahead a fixed distance each time may be along the lines of least resistance, but it does not always give the best results.

If properly used, there are practically no limitations to the use of the spot board. If used improperly, the results correspond to those which occur when anything else is done wrong. As to the sequence that should be followed: When making a start, the board should be set about five rail lengths in advance of the starting point and at an elevation corresponding to the raise that it is estimated the track should be given at the point of set-up. The sighting block is set on the rail at the starting point, with the raising or jack block at the first joint to be raised, the jacks being set two tie spaces ahead. The track is then raised until the top of the raising block is brought into line with the top of the sighting block and the sighting mark on the spot board. This process is repeated for all joints and centers, the jacks always being set two tie spaces ahead of the point to be raised and directly opposite each other. The rail opposite the sighting rail should be brought up with the track level. If for any reason the quarters do not come up to the plane of the centers and joints, they should be raised by eye. For 39-ft. rails, many foremen and supervisors prefer to raise at the joints and one-third points rather than at the joints and centers.

Where the spot board is set up on the rail, it is important that it be moved when the jacks have advanced to within one rail length of the setting, to avoid the possibility of the rail at this point being lifted while the board remains on it. Always, too, the sighting and raising boards should remain in position at the last raise when the spot board is moved ahead in order to permit such adjustment as seems advisable in the elevation at the next setting. These latter precautions are not necessary where grade stakes have been set.

▼ ▼ ▼

Protecting Street Traffic*

What precautions should be observed to protect highway and pedestrian traffic while making repairs to or renewing bridges across streets and highways ?

Plans Should Suit Public Authorities

By Division Engineer

Few contacts with the public can be more troublesome than those which have to do with the obstruction of public highways, and for this reason I would go to some length to avoid placing obstructions which might tend to retard the free flow of street or highway traffic. This cannot always be avoided, however, and where necessary, the plans should be worked out with the public authority having jurisdiction and in such a way as to limit the interference with traffic on the roadway to a minimum.

Where headroom permits, the construction of a canopy may meet all requirements of both the railway and the public. If falsework is required, it should be designed, so far as practicable, to reduce the obstruction to the roadway to a minimum. It should never be lost sight of, however, no matter what method is employed, that the hazard against which the protection is being provided comes from above, and that proper measures, of which the canopy already mentioned is one, should always be taken to insure that hot rivets, bolts, tools or structural pieces will not drop onto the roadway or sidewalks.

Proper flagging protection should be provided while the work is in progress and watchmen and red lamps should be provided for night protection wherever any obstructions are placed. One of the important things which is often overlooked or sometimes, perhaps, omitted purposely is the posting of signs to inform drivers approaching the work about the conditions ahead and the action they should take. These signs should be short and snappy and have large letters, so that any driver can read and understand them easily at a glance.

When removing or setting girders or erecting other structural members, traffic should not be allowed to pass under the structure until the unit is in the clear or has been landed and made fast. This stoppage is usually relatively short and seldom causes friction, because the travelers become so deeply interested in what is going on that they do not fret at the delay. It is well in such cases to arrange for uniformed police to handle the traffic at this time. I have found, too, that folks are less likely to grow impatient if one or two men who are familiar with the work can be assigned to answer the questions that they always like to ask on such occasions.

*A further discussion of this subject will be found on page 283.

Safety Should Be Feature of Any Plan

By Engineer of Bridges

Measures to insure observance of proper methods of protecting users of the street or highway affected should be incorporated in any plan for repairing or renewing a bridge across a public thoroughfare. The details of the methods to be employed are usually determined by the character of the work to be done and the local conditions at or surrounding the structure. If the work is of a minor character, a light canopy over the roadway and sidewalks may be all that is needed, or sometimes a heavier one is sufficient for more important work.

In cities it is often possible to close the street temporarily and occasionally this can be done in the case of a highway. If there is a support at the center of the street, permission may be obtained to close one traffic lane and one sidewalk at a time and arrange the work on this basis. There are many cases, however, where the closing of the street, even temporarily, is out of the question and in this event other measures must be taken. These may range from a heavy housing over the roadway and sidewalks to a flagman for the purpose of halting traffic for a moment or of slowing it down.

Not infrequently, it is necessary to erect falsework in such a way as to form an obstruction. Where this or any other form of obstruction is necessary, legible, pithy signs should be placed so that drivers, whether familiar or unfamiliar with the situation, will be fully informed of the conditions ahead, of the speed restrictions to be observed and of other precautions they should take. No obstruction of any character should be erected in or over a public thoroughfare without the placing of such signs and the assignment of one or more reliable watchmen with the necessary flagging equipment. Furthermore, every feature of the arrangement for these forms of protection should be submitted to the proper public authorities and approval obtained before they are put into effect.

▼ ▼ ▼

Setting Guard Rails

What sequence should be followed and what measurements taken when installing main-line guard rails on tangents? On curves? Do these differ for the guard rail on the turnout side ?

Guard Rails Have But One Function

By J. B. MARTIN
General Inspector of Track, New York Central, Cleveland, Ohio

Guard rails have but one function—to prevent wheels from coming into contact with the frog point. With this in mind, the design and installation should be such as to allow the wheels to pass through the frog and guard rail with a minimum shock to the equipment and the track structure. The first step in making the installation is to put the track to exact gage. This may be standard gage or whatever modification may be required by curvature. It should then be carefully lined. The second step is to place the guard rail so that the distance from the gage line of the frog to the wearing side of the guard rail is 4 ft. 6¾ in. regardless of the gage of the track, whether it is on tangent or curve or whether it is on the main-track or turnout side. This distance must not be greater, other-

wise it may exceed the back-to-back measurement of the wheels and result in damage or derailment. The distance from the running rail will depend on the gage of the track. Clamps or some other effective method of holding the guard rail in place should be employed.

It is good practice to set the guard rail off center, so that its middle point is ahead of the frog point, since the protection to the facing point of the frog is the main consideration and the only protection required back of the frog point has as its purpose a reduction of wear on the heel of the frog. The distance in front of the point will be governed by the length and design of the guard rail.

Should Be Set Only by Experienced Foremen

By A. H. REETZ
Supervisor of Track, Minneapolis & St. Louis, Hampton, Iowa

To install a guard rail requires a thorough knowledge of how to do it and careful attention on the part of the foreman to prevent incorrect work. On tangent track, a short guard rail, 8 ft 6 in. long will answer the requirements for main lines, provided the flangeway is 1⅞ in. wide and the track is standard gage at the frog point. On the turnout side, the length of the guard rail, the width of the flangeway and the gage at the frog should vary to meet local conditions, including the frog number and the length of lead. In most cases a guard rail, 11 ft. 6 in. long, will be satisfactory, provided the gage is ¼ in. wide at the frog point and the flangeway is made 1⅞ in.

Guard Rail Gage Is Fixed Rigidly

By DAVID MATTHEWS
Section Foreman, Chesapeake & Ohio, Maysville, Ky.

When installing a guard rail, the frog should first be spiked in proper position and the track brought to line and gage. The guard rail is then located from the frog and not from the running rail. The center of the guard rail should be shoved ahead toward the switch point about 6 or 8 in. The standard distance from the gage point of the frog to the gage side of the guard rail is 4 ft. 6¾ in., this dimension being fixed rigidly by the gage of the wheels. From the gage side of the wing rail of the frog to the gage side of the guard rail, the distance, also rigidly fixed, is 4 ft. 5 in. These distances must always be maintained. If the gage of the track is widened because of curvature, the width of the flangeway between the guard rail and the running rail is increased a corresponding amount. There is no difference in the manner of setting of the guard rail on the main-track and turnout sides.

When making a main-line installation on curved track, an entirely different situation is presented, particularly if the frog is on the high side of a curve. In this event it may be necessary to use a guard rail as much as 15 to 20 ft. long, with a flangeway 2 in. wide, and widen the gage by ½ in. at the frog point. The frog must be in correct line, however, and the widening done on the inside rail of the curve. This widening should be graduated so that by the time the end of the guard rail is reached, the gage is standard. By doing this, the wheels are pulled over gradually and the shock to both the guard rail and the rolling stock is lessened.

When trouble is experienced from either excessive wear or derailment at frogs, it will be found ninety-nine times out of a hundred that it is the result of insufficient guard-rail protection. Some types of locomotives are more rigid than others. We have had some pony-truck derailment at the frog point on main-line turnouts, with a certain type of locomotive. Inspection developed no track defects. The wheels did not go on the wrong side of the frog point, but climbed the rail just beyond the frog point. The guard rails in use at the points where the derailments occurred were 8 ft. 6 in. long. In every instance further derailments were prevented by installing longer guard rails.

▼ ▼ ▼

Salvaging Building Materials

To what extent is it practical or economical to salvage material and fittings when dismantling stations or other buildings for re-use in other structures ?

Considers It Good Practice

By A. T. HAWK
Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

Owing to the conditions which have confronted us during the last two years and the extreme necessity of economizing in every possible way, we have had to canvass every section of the road to obtain materials that are needed for urgent repairs. First, we cleaned up all odds and ends on the road. Then as we had other demands for material, we found that there were many buildings that were once very necessary to meet operating requirements, but which had become obsolescent and were no longer in use. Yet, we were paying taxes and insurance on them, and if they were to be continued they would require considerable maintenance.

Usually the smaller buildings were torn down at once and the usable material was salvaged to provide for the maintenance of structures that had to be kept in operating condition. This statement applies equally to lumber, pipe fittings, valves, boilers and other accessories. If a heating boiler in a station failed or was approaching the point of failure, we used one of these salvaged boilers, or if none was suitable, we canvassed the road for one that was no longer needed, which could be used to replace the one that had failed.

Success in recovering material from a dismantled depot depends in large measure on the location of the structure, the character or extent of previous repairs and the age of the building. Most of our old stations are situated in localities that are gradually dying out, so that they have been given a minimum of maintenance and salvage is correspondingly reduced. If a building was well-built, however, and has been properly ventilated from below, the floor joists should be good and they, together with most of the ceiling joists, rafters, studding and sheathing, can be salvaged. Little, if any, of the flooring is likely to be usable, but the furniture and fixtures should provide almost complete salvage. In fact, as a result of our campaign, we now have a considerable surplus of such equipment, particularly waiting-room settees.

In salvaging a heating plant, it is generally found that the boiler is usable, although minor repairs or replacements are often needed. Similarly, valves and other fittings are usually fit for further service, but pipe is seldom in condition for re-use, since a comparatively small amount of corrosion makes it impracticable to rethread it.

Years ago there was often a heavy freight transfer at junction points, and most of the transfer sheds were

quite large. Owing to changed operating methods, many of these structures are now obsolete, although some of them have continued to be used in a desultory manner. Considerable usable material can be obtained from these structures, mainly joists, rafters and roof boards. To economize, we have been following the practice of allowing the divisions to dismantle these buildings progressively as they need material for use. In this way, the labor cost of dismantling is spread over several months.

Several things have been accomplished by the practice described. We are eliminating buildings that are no longer used; we have been obtaining usable material, thereby avoiding the purchase of new material at a time when funds for this purpose are restricted; we have been able to reduce our taxes; we have reduced our fire insurance premiums; we have reduced the fire hazard to those buildings that must remain; and we have eliminated the necessity for future maintenance.

In General, It Is Not Economical

By Assistant Engineer of Buildings

In general, it is not economical to salvage material from railway buildings that are being dismantled. There are circumstances, however, where this can be done to advantage. For instance, assume that there is a building scheduled for dismantling. It is generally preferable to allow the building to stand until such time as immediate use can be made of the salvaged material, say, in the construction of a new building elsewhere. This building can often be designed with this specifically in view, particularly with respect to doors, windows and the larger timbers. If this cannot be done to advantage, I would consider it better to dispose of the structure locally for moving off the right of way.

It is always well to salvage the plumbing fixtures, heating plant and electric fixtures as soon as it has been decided to abandon the structure. If the building is at a division point where the bridge and building forces have headquarters, it is sometimes economical to dismantle it and store the salvaged parts where they can be supervised easily.

▼ ▼ ▼

Settlement in Pipe Culverts

What measures, if any, can be employed to avoid undesirable settlement and probable distortion of line or grade of pipe culverts where the foundation material is unstable ?

Provision for Camber Often Sufficient

By L. W. SKOV

Office Engineer, Chicago, Burlington & Quincy, Chicago

Since the culvert will not settle more than the fill through which it is to be placed, the method to be employed will depend in large measure on the amount of subsidence expected as a result of placing the fill. Ordinarily, the best way is to provide sufficient camber in the line of pipe at the time it is laid to insure that there will be no sag in the grade line when settlement is complete.

In all cases the pipe should be bedded along the lines developed by Dean Marston, i.e., so that it receives uniform vertical and lateral support throughout its length. Where soil conditions are so unstable that enough camber cannot be provided, piles must be driven, capped and decked and a proper bedding provided for the pipe. Under such conditions, special consideration must be given to the magnitude of the load to be carried by the piles, since this will be greater than the superimposed load of the pipe and the filling material directly over it. The building of floors to spread the load underneath culverts is usually not successful, as the soil surrounding the pipe is loaded as heavily as that under it.

Fit Pipe to Grade Line of Waterway

By W. E. TILLETT

Assistant Foreman, Chesapeake & Ohio, Maysville, Ky.

Not infrequently a pipe culvert must be installed at a point where the natural ground, while not completely unstable, is not capable of fully resisting the weight of the superimposed fill, so that considerable subsidence may occur. This not only depresses the pipe as a whole, but causes more depression at the center, where the greater load is applied, than at the ends. For this reason, the pipe should be cambered so that in its final position there will be no sag in the grade line. In many cases it is advisable to prepare a bed somewhat above the natural ground so that when settlement is completed, the pipe will fit in with the average grade line of the waterway. This will greatly relieve the burden otherwise thrown onto the maintenance forces, of being compelled to keep a culvert open that is below the flow line of the waterway in which it is laid.

If the foundation material is so soft as to make it certain that settlement will be excessive, with probable vertical and lateral distortion of the culvert, the objectionable material should be removed to secure a firm foundation and replaced with dependable material. I have seen extreme cases, however, where it was necessary to drive piles and erect a platform for the purpose of carrying the pipe.

Placing in Trench Reduces Vertical Pressure

Bv A. R. KETTERSON

Assistant Engineer of Bridges, Canadian Pacific, Montreal, Que.

It is preferable to place the pipe in a trench, making the excavation just wide enough to permit the placing of the pipe, except at the joints where greater width is needed to make connection between sections. These widened places should be reduced to a minimum where it is practicable to connect two or more sections at a time before they are lowered into the trench. The bottom of the trench should be shaped to fit the lower part of the perimeter of the pipe. Where this is not feasible, the ditch should be made only wide enough to permit the backfill to be thoroughly tamped under the haunches of the pipe. If the soil contains loose stones, boulders or stumps, the bottom of the ditch should be tested with a bar to insure that all hard matter is at least 9 in. from the surface. In very soft ground the load distribution can be improved and excessive deflection prevented by laying the pipe on a mattress of saplings that is covered with a layer of earth and firmly tamped.

Placing the pipe in a trench not only reduces the vertical pressure it must resist, but it enables the tamping of the backfill between the pipe and the walls of the trench to be more effective since it is being consolidated between the comparatively unyielding surface of the pipe and the undisturbed earth which forms the walls of the ditch. This procedure will also minimize the tendency toward lateral movement, except in those

extreme cases where the whole terrain moves for some depth below the surface, in which case, obviously, the culvert must follow the movement of the ground. I assume, however, that the question was not intended to cover this condition.

As a further precaution, it is advisable to deposit the fill for several feet above the top and beyond the sides of the pipe, in horizontal layers, each of which should be well tamped. This will make any variation in pressure change gradually and thus minimize unequal settlement. All of these precautions add to the cost of installation, but on the other hand it is a sheer waste of money if, when laying pipe in doubtful soil, no greater precautions are taken than for the average case in which the pipe rests on a firm foundation.

Care should be taken to insure that all of the water reaching the up-stream portal of the culvert is guided into the pipe and that none of it is permitted to seep through the fill alongside the pipe, as it will tend to impair the foundation. Instead of the usual paving and rubble headwalls, it seems advisable to lay a concrete apron approach, preferably reinforced with wire mesh, projecting several feet beyond the end of the pipe and tapered in plan to guide the water into the culvert. The type of pipe should also be considered. In general, a flexible type is preferable to a rigid type for the conditions under discussion.

In fixing the grade, allowance should be made for the greater settlement that will probably occur at the point of maximum vertical pressure. In other words, the pipe should be cambered to insure that when settlement does occur, the pipe in its final position will not have a sag below the average grade line joining the inlet and outlet.

▼ ▼ ▼

Pumpers' Reports

In what detail should pumpers be required to make reports of the operation of water stations? Of what value are such reports? How should they be used ?

They Furnish Current Information of Value

By Foreman of Water Stations

It has been my practice for many years to require pumpers to keep a record in triplicate of the daily performance of their water stations and send me duplicate copies of this record at the close of the last day of the month. I keep one copy and forward the other to the chief engineer as we have no specially organized system water service department. These reports have a very definite value, not only as a current record of performance from which unusual conditions, sometimes not otherwise apparent, can be quickly and easily detected, but also as a permanent record which becomes the only source of reliable information when considering the replacement or modernizing of the station or its equipment. Again, as these stations have been improved, the continuous record which the reports provide gives us an excellent basis for computing the economic value of the investments which these improvements represent. In other words, they provide the concrete evidence upon which we can justify expenditures for other improvements, since we have available a specific record of unit costs of operation before and after the improvement was made and are able to show the savings that have been accomplished, as well as the better physical performance.

Pumpers' reports also have a further value in that they enable the officer in charge to compare the performance of the various pumpers, especially at those stations where the equipment is similar, and thus permit him to concentrate his attention on the less efficient plants and bring them closer to the average performance. No operation can be carried out efficiently unless it is systematized. Neither can supervision be of maximum value unless the supervisory officer knows currently what is happening in the field of which he has charge. Pumpers' reports fulfill both requirements —they aid in keeping the operation systematized and they provide current information with respect to the performance of each water station.

Reports Should Be Concise but Informative

By E. M. GRIME

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

As a general rule, pumpers, from the very nature of their work, dislike to make reports. They are inclined to feel that if they keep the machinery in good working order and plenty of water in the storage tank they have done their duty. This characteristic must be recognized and for this reason it is desirable that a minimum of reports be required from these men. Such reports should be as concise as is practicable, at the same time providing all necessary information. Having been provided with such a form of report, pumpers should be required to fill it out carefully every month so that the data will be dependable for a reliable office record at headquarters.

Railway pumping stations range from the simple type, where the water is lifted from a reservoir, stream or well into the storage tank in one pumping operation by means of one of the numerous types of pumps and prime movers utilizing steam, fuel oil or electricity, to stations that are complicated in design and operation, where in addition to pumping, there may be coagulation, sedimentation, filtration and chemical treatment, all to be handled by the one man who is classed as a pumper.

As a matter of economy and simplicity it is desirable to have but one form for use at all types of pumping plants, including those where water softening is an important part of the work. The form which we use is printed on letter size paper, 8 in. by 10 in., and has served satisfactorily for all conditions on the Northern Pacific for the past seven years. It is made in triplicate by the pumper who forwards two copies to the supervisor of bridges and buildings to whom he reports. After being checked by the supervisor, or the water inspectors in treated-water districts, both copies are forwarded to the district accountant, who fills in the prices of the supplies and extends the amounts in the columns provided for this purpose. One copy is then returned to the supervisor and the other is forwarded to the engineer of water service where it becomes the basis for the annual report of water-station performance.

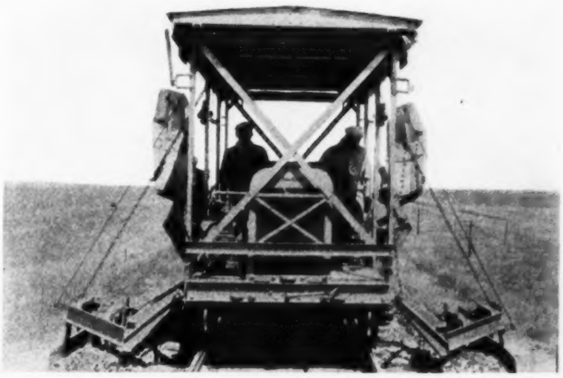
Reports of this kind furnish desirable information which is needed when studying the problem of abandoning or modernizing certain water stations. At all times they provide data of value to supervising officers, covering the total cost of operation of each station. Requiring the pumper to compile this record has value also because it keeps before him the fact that someone at headquarters is watching performance and the consumption of supplies and is expecting him to put forth his best efforts.

New and Improved Devices

New Fairmont Ballast Scarifier

WITH a number of improvements, the M23 5-ton, 80-hp. traction unit manufactured by Fairmont Railway Motors, Inc., Fairmont, Minn., and described in *Railway Engineering and Maintenance* for March, 1929, is now being used successfully for draining water-bound rock-ballasted track. Each side of this traction unit is now equipped with two separate wings, one in front for scarifying and another at the rear for blading. This arrangement permits changing from one operation to the other merely by switching the pneumatic hoist cable from one wing to the other.

The scarifiers, which are mounted rigidly on shanks of flat bar stock bolted to electrically-welded wings, have self-sharpening points of chrome molybdenum alloy steel which are double-pointed and reversible. The blades on the rear wings, which are furnished from 3 to 6 ft. long, are so hinged that their outer ends may be swung either backward or forward at various angles for blading loosened rock toward the ties or for wasting foul gravel down the bank. The blades are adjustable to accommodate them to various depths and slopes of the shoulder. By rolling the rock sideways several times and settling the dirt downward it is said that this machine closely parallels the action of cleaning ballast by hand with forks.



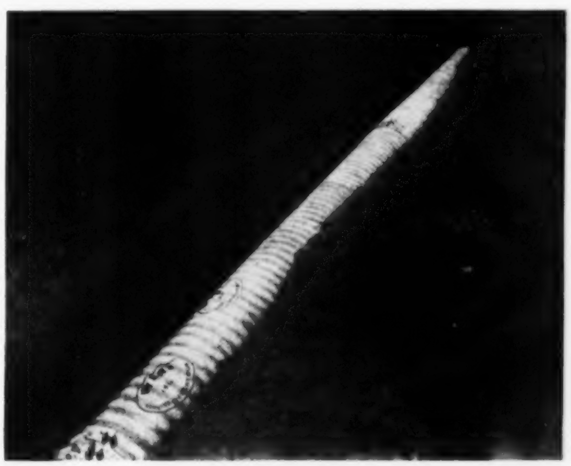
A View of the M23 Scarifier and Blader

With the scarifiers in operation, this machine rolls the rock and dirt mixture out against a stop plate, while at the same time, an adjustable under-cutter breaks the watertight wall around the ends of the ties, allowing wet pockets in the cribs to drain. An average of from three to five trips is made with the scarifiers, each time cutting two to three inches deeper than before and breaking each piece of rock loose from the dirt surrounding it. The rock is then bladed back to the ends of the ties, preferably after drying, and a second trip with the blader shapes the shoulder to the approximate standard. This operation is possible in intertrack spaces as well as on shoulders. The machine is said to finish from 1 to 2½ miles of track daily, at a cost of about $20 a day for labor, gasoline and oil.

Culverts of Wrought Iron Developed by Byers

CORRUGATED culverts of genuine wrought iron have been placed on the market by the A. M. Byers Company, Pittsburgh, Pa., a development made possible through the perfection by this company of a process for producing wrought iron in quantities comparable with steel. It is said that wrought iron was used by James H. Watson in the manufacture of the first corrugated culvert in 1899 and that more than 85 per cent of the wrought iron culverts installed by Mr. Watson, although not galvanized, were still in service in 1926.

In the present-day manufacture of corrugated wrought iron culverts the sheets are first rolled to a thickness of 12 to 16 gauge, depending on the size of the pipe to be formed, and are then galvanized on both sides, a minimum coating of two ounces of zinc per square foot being applied. These sheets, which have a width of about 24 in. with allowance for riveting, are given corrugations ⅝ in. deep and 2½ in. center to center. The sheets are then rolled to the proper diameter and riveted together to form culverts of the



An Installation of a Genuine Wrought Iron Culvert Pipe

desired length. The sections may be obtained in any multiple of 2 ft., although 20 ft. sections are considered standard. Where longer sections are required, these standard lengths are joined with connecting bands of the same material. The gauge and weight per foot of the various diameters of wrought iron pipe are given in the accompanying table.

Dimensions of Standard Wrought Iron Culverts

Diameter	Gauge	Weight per foot	Diameter	Gauge	Weight per foot
8 in.	16	7.3	24 "	14	25.2
10 "	16	9.0	30 "	14	30.9
10 "	14	11.0	30 "	12	43.3
12 "	16	10.5	36 "	14	38.0
12 "	14	12.9	36 "	12	51.0
15 "	16	12.9	42 "	12	59.5
15 "	14	15.7	48 "	12	68.0
16 "	16	13.8	54 "	12	77.8
16 "	14	16.8	60 "	12	85.0
18 "	16	15.3	66 "	12	96.0
18 "	14	18.8	72 "	12	106.0
21 "	14	22.0			

In addition to its use for culverts, wrought iron is also available in the form of drainage pipe, which is similar to corrugated culvert pipe except that the top of the pipe is perforated to allow for the seepage of soil drainage.

Chipman "Pack-Back" Sprayer for Weed Killing

A PORTABLE weed-killing unit, known as the Chipman pack-back sprayer, which is carried on the back of the operator, has been placed on the market by the Chipman Chemical Company, Bound Brook, N. J. This unit consists of a metal container having a capacity of 3½ gal. and weighing 20 lb. when empty, which is equipped with an adjustable flexible laced canvas carrier for distributing the load evenly on the back of the operator.

Chemical is discharged from the container through an adjustable nozzle, by means of which three types of spray may be developed through the use of interchangeable nozzle discs. These include a flat fan spray, a full or solid cone spray and a projecting spray. The spray stream is controlled by a quick-opening hand-pressure valve, and the handle of the spray rod encloses a special filter which can be cleaned easily. An extension rod of proper length separates the spray valve and the nozzle. Continuous pressure is maintained by a self-contained diaphragm pump, which is operated by a hand lever. The lever is adjustable for varying arm lengths.

Illustrating the Chipman Pack-Back Sprayer in Use

Parts of this unit that are subject to corrosion are made of brass, while iron is used where strength is required. The inner pressure chamber consists of an artillery shell case, and the pump valves are of a special design to prevent clogging or leakage.

A New Safe Fumigator

AS A means of simplifying the fumigation of all classes of railroad cars and buildings with Railroad Calcyanide, and of further increasing the safety with which this fumigant can be used, the Calcyanide Company, New York, has developed a self-contained fumigator, called the Calcynator, which makes it possible to treat any area without entering it after it has been prepared for fumigation. The Calcynator, which is a simple, compact unit, consists essentially of a two-part, conical-shaped fumigant hopper, with a forced air inlet at the bottom; a gas filter bag fitted over the top of the hopper; and an outside, gas-proof rubber bag, surrounding the filter bag, from which the fumigating gas is drawn off and forced into the area to be fumigated.

The Calcynator

When in use, the Calcynator is set up on removable legs. The inlet hose at the bottom is equipped with a 110-volt, universal motor-driven blower, which forces air into the base of the fumigant hopper. As the air passes through the hopper and the powder fumigant contained therein, the fumigant is blown about and aerated in the inner filter bag, which becomes fully inflated. Filtering through this bag, the gas inflates the outer gas-proof rubber bag, from which it is allowed to pass off through hose outlets in the holder at the base of the bag.

In fumigating camp cars or other types of cars, the cars are first made as air-tight as possible, using paper or rags, where necessary, to seal cracks. With the Calcynator outside the car, the free end of the air inlet hose is inserted into one of the car windows, to best advantage through a hole near one end of a piece of board, the width of the car window and about five inches high, placed in the lower part of the window frame. The free end of the outlet hose is then inserted in the

same window through a hole provided in the opposite end of the board. The blower motor is then turned on. This draws the air out of the car, passes it through the fumigant powder in the Calcynator, and then forces the gas generated through the outlet hose and into the car.

This recirculation of the air in the car is permitted for about one hour, during which time practically complete evolution of the gas in the fumigant occurs. The blower is then stopped, the inlet and outlet hoses are withdrawn from the window, and the holes are sealed shut. The gas is permitted to remain in the car for a period of about four hours, during which time the Calcynator may be used in fumigating other cars.

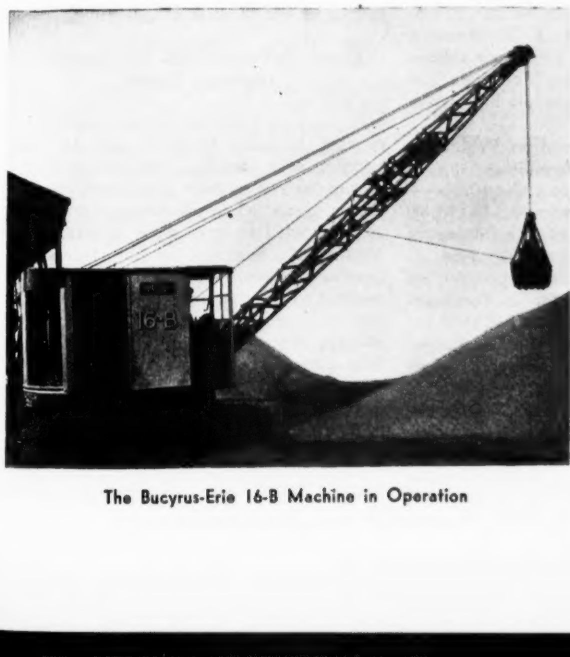
The ventilating of fumigated cars is effected readily by opening the end doors, but it can be speeded up if side windows can be opened also from the outside, or by reintroducing the inlet hose of the Calcynator into one of the window holes used previously and sucking out the gas. Adequate ventilation to permit safe entry into a car requires from 30 to 45 min., depending upon the movement of air outside the car.

Among the many pests susceptible to the gas from Railroad Calcyanide are bedbugs, cockroaches, lice, fleas, silverfish, mosquitoes, waterbugs, flies, moths, carpet beetles, rats and mice. It is said that the gas has great penetrating power, entering cracks and spaces where insects and rodents may be in hiding, and, furthermore, that the gas destroys adults, larvae, pupae and eggs, without damage to clothing, upholstery, paint, woodwork, metals, foodstuffs or other substances or materials.

Develops New ½-Yd. Excavator

The Bucyrus-Erie Company, South Milwaukee, Wis., has developed a ½-cu. yd. excavator, known as the 16-B, which weighs less than 30,000 lb. and yet is powered with a six-cylinder gasoline engine that develops 54 hp. This large horse-power per pound of weight has been made possible by what is said to be an entirely new design embodying principles not heretofore employed in the construction of such equipment.

The revolving frame of this excavator is supported by three double-acting conical swing rollers which operate between two conical roller paths embodied in the truck frame and swing circle. The necessity for a center pintle is eliminated by this design which is claimed to reduce materially the stresses in both the revolving and truck frames. The machinery and power unit are designed to counterbalance the front end and digging forces, thereby eliminating the necessity for a dead counterweight.



The Bucyrus-Erie 16-B Machine in Operation

Unit-assembly construction is employed in the design of this machine. All friction clutches are identical and interchangeable, and the propelling brake and steering clutches of the single-shaft drive caterpillar mounting are controlled from the operator's seat with the cab in any position. It is said that this machine, which has a line speed of 170 ft. per min., and a swing speed of 5 r. p. m., will readily climb grades of 30 per cent.

Both the boom and the outside dipper handles are of welded all-steel box-girder construction, stiffened with transverse diaphragms. The forged dipper teeth of the self-cleaning inserted-tooth dipper are quickly removable for sharpening or replacement.

This machine may be operated by either gasoline, Diesel or electric power. Extra equipment that is available includes a two-speed propelling drive which utilizes the crowd machinery by means of special propelling shafts and a double-jaw clutch, and a high-speed spur-gear-driven independent boom hoist equipped with a safety brake. The 16-B is convertible for use as a shovel, dragline, clamshell, crane, dragshovel or skimmer scoop.

What Our Readers Think

Waiting for Someone Else

Youngstown, Ohio

To the Editor:

Your letter on "The Hitch Hiker" which appeared in the May issue of *Railway Engineering and Maintenance* is timely and interesting. Within the last few years we have become almost a nation of hitch hikers, from the man of wealth who is waiting for the other man to start things going, to the type of laboring man who is willing to be supported by the community.

I am in full sympathy with the message your letter conveys.

A. E. Brown
General Manager Railroad Department,
Truscon Steel Company.

We Hope So Too

Chicago

To the Editor:

I have just read your letter in the May issue on The Hitch Hiker, as applied to those who "sponge" on the generosity of others.

Like all companies that are endeavoring to balance their budgets, we have discontinued subscriptions to many different publications but we have retained both *Railway Engineering and Maintenance* and the Railway Age on the list of publications that come to this office. Your magazines enable us to keep up with the times; they are a means of self-education and contain information that is of aid and assistance to railway men and manufacturers alike in keeping abreast of developments during the period through which we are passing.

With the gradual improvement in business, I hope that those of your old readers who have neglected to "pay for the gas" will come back, not only with their subscriptions but with full-page advertisements as well.

G. W. Morrow
Ingersoll-Rand, Inc.

News of the Month . . .

Franklin Institute Honors Industrial Brownhoist Company

At the Medal Day exercises of the Franklin Institute of the State of Pennsylvania, held in the hall of the institute in Philadelphia on Wednesday, May 17, one of the three John Price Wetherill medals awarded by the institute was presented to the Industrial Brownhoist Corporation, Bay City, Mich., "in consideration of the high degree of ingenuity in design and execution of detail, embodied in a successful machine for cleaning railway ballast, resulting in a real contribution to railroading and the solution of a maintenance problem of great moment, especially under traffic conditions of extreme density." This machine was described in *Railway Engineering and Maintenance* for January, 1928.

Railway Purchases in 1932 Drop to Low Level

The Class I railroads of the country expended $445,000,000 for fuel, materials and supplies in 1932, which was a reduction of $250,000,000, or 36 per cent, below expenditures for 1931; $593,000,000, or 57 per cent, less than in 1930; and about $885,000,000, or 67 per cent, less than in 1929, according to figures compiled by the Railway Age. The total for 1932 included about $178,000,000 for fuel, $30,800,000 for ties, $15,500,000 for rail and $220,700,000 for other materials. The expenditure for ties compared with about $51,000,000 in 1931, $84,000,000 in 1930 and $93,000,000 in 1929, while that for rail in 1932 compared with $41,500,000 in 1931, $75,000,000 in 1930 and $94,000,000 in 1929.

More States Pass Motor Truck Legislation

Measures looking to more extensive control of motor carriers have recently been enacted by the legislative bodies of four more states, namely, Tennessee, Rhode Island, Oregon and South Carolina. Four laws passed in Tennessee provide for control over the traffic-soliciting activities of so-called "motor transportation agents" and "motor freight brokers," reductions in the sizes and weights of motor vehicles permitted on the public highways, and payments by motor carriers for their use of the highways. Comprehensive regulations for intra-state common and contract motor vehicle carriers and some measure of control over interstate and private carriers on the highways are provided in the "Motor Transportation Act" recently enacted in Oregon, while limitation of the hours of service of motor vehicle operators is provided for in a statute recently enacted in Rhode Island. The South Carolina legislature has passed a bill restricting the weights and dimensions of motor trucks in the interest of economy in highway construction and maintenance costs and to provide for the safety of the traveling public.

Urges Grade Separation Program for Unemployment Relief

"Unemployment relief granted to the states should include money for the elimination of grade crossings, and reconstruction of existing bridges or grade separation structures where necessary to meet new traffic conditions," said A. J. County, vice-president of the Pennsylvania, at a recent meeting held under the auspices of the National Industrial Conference Board at New York. Mr. County also suggested as measures for unemployment relief that the Reconstruction Finance Corporation grant 20-year loans to railroads for improvements and that the corporation extend the terms and reduce the interest on present rail loans.

Yale Awards Strathcona Fellowships

Yale University, New Haven, Conn., has made its annual award of five fellowships in transportation as provided in the bequest of Lord Strathcona. The recipients of this award are permitted to study transportation subjects at Yale for one school year and are awarded a cash sum to be used for this purpose. Applicants from Canada and the Northwestern part of the United States are given preference in awarding the fellowships. The five men to be awarded the fellowship for the coming year, all of whom have had railroad experience, are: R. A. Emerson, Morden, Man.; S. M. Gossage, Montreal, Que.; T. M. C. Martin, Wausau, Wis.; P. E. Savage, Montreal; and L. R. Shellenbarger, Hopkins, Minn.

Reduction in Appropriation Will Curtail I. C. C. Activities

Appropriations amounting to $5,040,000 for the work of the Interstate Commerce Commission for the fiscal year 1934, as compared with $7,148,560 appropriated for 1933, are provided for in the independent offices appropriation bill now before the United States House of Representatives. This is the amount recommended by the Bureau of the Budget in place of the $7,137,639 provided in the bill which was passed by Congress at the last session but was vetoed by President Hoover. It is reported that the reduction in the expenses of the commission made necessary by the lower appropriation will be effected in a degree through additional salary cuts, but that the major portion of the reduction will require administrative furloughs, dismissals, and a general curtailment of all activities.

Rail Net Lower in First Quarter

Class I railroads of the United States for the first three months of 1933 had a net railway operating income of $33,909,385, which was at the annual rate of return of 0.67 per cent on their property investment, as compared with a net of $65,478,083, or 1.29 per cent, in the same period of 1932, according to reports compiled by the Bureau of Railway Economics. Operating revenues for the three months totaled $655,232,659, as compared with $820,803,386 for the same period in 1932, or a decrease of 20.2 per cent, while operating expenses amounted to $527,334,364, as against $653,162,870, a decrease of 19.3 per cent. Seventy-three Class I railroads failed to earn expenses and taxes in the first quarter of 1933.

Rails Underbid Buses for Transport of Forestry Corps

The railroads appear to have succeeded in underbidding the buses for the transportation to and from the state and national forests of the members of the Civilian Conservation Corps, who are to be employed for relief purposes in reforestation and similar work under the provisions of the law recently passed by Congress. The movement is to include round trips for 250,000 men to and from the various camps and it is estimated that it will amount to from $10,000,000 to $15,000,000 in total fares. The National Association of Motor Bus Operators submitted a bid of 1.7 cents per passenger-mile in regular equipment over regular routes, whereas the Western roads offered a bid of 1.25 cents a mile for 99 persons or less and 1 cent a mile for 100 or more. The failure of the bus companies to propose lower fares than they did is said to have been somewhat of a surprise to army officials because this presented an opportunity to demonstrate their possibilities in the mobilization of a large number of men at one time.

Need Railway Taxes to Support Highway Bonds

Because railroad taxes are needed to support highway bonds issued for the building of a parallel hard-surface highway is no reason why a railroad should not be permitted to abandon an unprofitable branch line, according to Examiner Thomas F. Sullivan, of the Interstate Commerce Commission, who has recommended to the commission that it authorize the Norfolk & Western to abandon a 54-mile branch line in West Virginia. The company had shown that the continued operation of the line is not justified by the traffic available or in prospect, and that such operation results in heavy deficits, but representatives of the state and local communities protested that the loss of taxes resulting from the

abandonment of the line will impair the ability of the political units involved to meet obligations incurred in the construction of highways.

Tie Stocks Are Reduced

The supply of crossties in the hands of tie producers on April 1 was smaller than in any previous month this year and was also the smallest stock on record, according to reports made to the Railway Tie Association by companies handling approximately 85 per cent of the commercial output. The number of ties in the yards of these companies on April 1, 1933, totaled 5,655,550, as compared with 5,745,597 on January 1; and 7,612,885 on April 1, 1932. Of the ties on hand on April 1 of this year, 461,723, or approximately 8 per cent of the total, were for use untreated; 4,133,389, or 73 per cent, were oak ties for treatment; and 1,060,438 or about 19 per cent, were ties of all other species for treatment.

More Farm Crops Trucked to Market Last Year

Motor-trucked receipts of fruits and vegetables in eight markets last year, including Boston, New York, Philadelphia, Kansas City, Denver, Salt Lake City, San Francisco and Los Angeles, were equivalent to 158,000 carloads as compared with 136,000 carloads in 1931, according to figures compiled by the Bureau of Agricultural Economics, U. S. Department of Agriculture. The trucked receipts were approximately 37 per cent of the total receipts by rail, boat and truck combined, as compared with 31 per cent in the preceding year. The Bureau finds that considerable quantities of fruits and some vegetables are trucked 500 or more miles to market.

Atterbury Proposes Railway Relief Program

A five-point program for the rehabilitation of the railroads was proposed by Gen. W. W. Atterbury, president of the Pennsylvania, in an address before the annual convention of the Chamber of Commerce of the United States on May 4. Gen. Atterbury's program involved the following measures: (1) Acceptance of the principle that there is a relationship between rates and wages, and that the control of both must be so tied together that the governmental body which has the responsibility of regulating the one must not only have first-hand knowledge of the other, but also its control; (2) assistance by the government in the form of long-term low-rate financing; (3) The regulation applied to the railroads should be more liberalized and brought back to its original basis, and all competing forms of transportation should be regulated on an equal basis with the railroads; (4) the appointment of a railroad co-ordinator as a temporary expedient, pending permanent regrouping of the railway lines; and (5) ultimate consolidation of all railroads into a very limited number of systems in the interest of efficiency and economy.

Association News

International Railway Maintenance Club

Thirty-seven members and seven guests were in attendance at the meeting of the International Railway Maintenance Club held on May 5 in the Royal Connaught Hotel at Hamilton, Ont. The speaker at the meeting was J. A. Drain, Jr., of the Sperry Products Company, who presented a paper, illustrated with lantern slides and motion pictures, on the Sperry method of rail flaw detection.

American Railway Engineering Association

Four committees held meetings during the past month. Sixteen members attended the meeting of the Committee on Iron and Steel Structures at Madison, Wis., on May 4 and 5; there was an attendance of 33 at the meeting of the Committee on Track at Cincinnati, Ohio, on May 12. The Committee on Records and Accounts met at New York on May 16 and the Committee on Maintenance of Way Work Equipment met at Chicago on May 23, with an attendance of 12. The Committee on Economics of Railway Labor met at St. Louis, Mo., on May 26, and the Committee on Rivers and Harbors at Chicago on May 29.

Metropolitan Track Supervisors' Club

The most recent meeting of the Metropolitan Track Supervisors' Club was held on Tuesday, April 25, in New York City. The feature of the meeting was a paper presented by George M. Cooper, Ramapo Ajax Corporation, on developments in the design of frogs and switches. Thirty-four members and guests were present.

The next meeting will be the annual meeting, which will be held on Saturday, June 17, at Keen's Chop House, 72 West Thirty-Sixth street, New York City. The feature of this meeting will be the annual dinner, with entertainment and the election of officers. The group will assemble at 3:30 E. S. T. and dinner will be served at 5:30.

National Industrial Recovery Act

A bill, designated as the National Industrial Recovery Act, which will authorize the president to "aid in the financing of such railroad maintenance and equipment as may be approved by the Interstate Commerce Commission as desirable for the improvement of transportation facilities" was introduced in Congress on May 17 upon the recommendation of President Roosevelt. In addition the bill contains provisions for a great co-operative movement throughout all industry "to obtain wide re-employment, to shorten the working week, to pay a decent wage for the shorter week and to prevent unfair competition and disastrous overproduction."

Personal Mention

General

W. A. Mather, general superintendent of the Canadian Pacific, with headquarters at Calgary, Alta., who spent a number of years in the engineering department of this company, has been appointed assistant to the vice-president, with headquarters at Montreal, Que. Mr. Mather entered the service of the Canadian Pacific as an axman in the construction department and, after serving as tapeman, rodman, instrumentman and transitman, became a resident engineer on construction, with headquarters at Winnipeg. He subsequently served as resident engineer in the engineering department in western territory and, on January 1, 1913, became superintendent of the Kenora division. He later served as superintendent at Medicine Hat, and as assistant general superintendent at Vancouver, B. C. In October, 1918, Mr. Mather was appointed general superintendent of the Saskatchewan district, with headquarters at Moose Jaw. On December 1, 1932, he was transferred to the Alberta district as general superintendent, with headquarters at Calgary.

William B. Storey, president of the Atchison, Topeka & Santa Fe, and formerly chief engineer of this company, has retired from active service. Mr. Storey was born in San Francisco, Cal.,

William B. Storey

on November 17, 1857, and graduated from the University of California in 1881. Prior to his graduation from college he served the Central Pacific (now part of the Southern Pacific) as an axman, chainman and rodman, and following his graduation he returned to that company to serve successively as a rodman, instrumentman and assistant engineer on construction until 1885, when he became a member of an engineering firm in San Francisco. From 1886 to 1893 he was with the Southern Pacific as an assistant engineer, then going with the U. S. Debris Commission as an assistant engineer. In 1895 he was ap-

pointed chief engineer and general superintendent of the San Francisco & San Joaquin Valley, which was later taken over by the Santa Fe. Five years later Mr. Storey was appointed chief engineer of the Eastern Lines of the Santa Fe and in 1906 he was advanced to chief engineer of the entire system, with headquarters at Chicago. For a year beginning with 1910 he served as vice-president in charge of construction and at the end of that period he was made vice-president in charge of operation and construction. Under government control of the railroads, Mr. Storey was federal manager of the Santa Fe, being elected to the presidency on the termination of federal control in 1920.

Engineering

F. E. Ladd, assistant supervisor of track on Subdivision 17, St. Lawrence division, of the New York Central, with headquarters at Watertown, N. Y., has been promoted to assistant division engineer of the St. Lawrence division, with the same headquarters, succeeding **C. A. Maxeimer,** who has been promoted to supervisor of track as noted elsewhere in these colmuns.

Benjamin W. Guppy, engineer of structures of the Boston & Maine, with headquarters at Boston, Mass., has been appointed also to a similar position with the Maine Central and the Portland Terminal Company, with headquarters at Portland, Me. **W. H. Norris,** bridge engineer of the Maine Central, has been appointed assistant engineer of structures of that road and the Portland Terminal Company, with headquarters as before at Portland.

Robert A. Rutledge, district engineer on the Western Lines of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has retired after 36 years of continuous service with the Santa Fe. Mr. Rutledge was born on December 13, 1863, at Jamestown, Pa., and was educated in civil engineering at the University of Kansas. He entered the service of the Gulf, Colorado & Santa Fe in 1897 as an instrumentman and was promoted successively through the positions of assistant engineer, division engineer and district engineer. In 1915, he went with the Santa Fe as chief engineer of the Eastern Lines, with headquarters at Topeka, Kan., and in 1917 he was appointed district engineer of the Western Lines at Amarillo, the position he was holding at the time of his retirement.

J. Davis, superintendent of the Omaha and Northern Kansas divisions of the Missouri Pacific, with headquarters at Falls City, Neb., has been appointed to the newly-created position of district engineer of the Southern district, with headquarters at Little Rock, Ark. **E. Sullivan,** assistant superintendent at Pueblo, Colo., has been appointed to the newly-created position of district engineer of the Western district, with headquarters at Kansas City, Mo. **R. G. Bush,** assistant engineer, with headquarters at Kansas City, has been promoted to division engineer of the Southern Kansas and Central divisions, with headquarters at Coffeyville, Kan., to succeed **R. M. Smith,** who has been appointed assistant superintendent at Pueblo, Colo.

Track

W. A. Bulmer, acting roadmaster on the Campbellton division of the Canadian National, has been appointed roadmaster on the same division, with headquarters at Campbellton, N. B. **William Keays,** extra gang foreman on the Campbellton division, has been appointed acting roadmaster on the same division, succeeding **A. Astle,** deceased.

C. Feucht, roadmaster on the Union Pacific, with headquarters at Salina, Kan., has been promoted to the newly-created position of general roadmaster, with headquarters at Kansas City, Mo. **O. C. Wilkes** has been reappointed general roadmaster at Omaha, Neb., this position having been abolished in January. **W. C. Perkins,** formerly a division engineer on the Oregon Short Line (part of the Union Pacific System), has been appointed to the newly-created position of general roadmaster at Pocatello, Idaho.

A. H. Sturdevant, master carpenter of the Oklahoma division of the Chicago, Rock Island & Pacific, has been appointed roadmaster, with headquarters as before at El Reno, Okla., succeeding **C. M. Webb,** who has been assigned to other duties. **F. Kirk,** master carpenter of the El Paso division, with headquarters at Dalhart, Tex., has been appointed roadmaster, with the same headquarters, to succeed **C. J. Gardner,** who has been transferred to Amarillo, Tex., to succeed **J. E. Crawford,** who has been assigned to other duties. Only a month previously Mr. Crawford had been transferred from Manhattan, Kan., to Amarillo to succeed **W. H. Gruhlkey,** who has retired.

J. W. Hicks, who has been appointed track supervisor on the Boston & Maine at Plymouth, N. H., as announced in the May issue, was born on December 11, 1878, at Underhill, Vt., where he received his education in the public schools. He entered railway service with the Boston & Maine as a laborer on September 3, 1897, and then left the service in May, 1901, returning as a laborer and assistant foreman on June 18, 1908. On May 4, 1911, he was promoted to section foreman, with headquarters at Hillsboro, N. H., and on June 18, 1916, he was made an extra gang foreman with the same headquarters. On May 1, 1927, he was promoted to general foreman and assistant track supervisor, serving as such on the Portland, Terminal and New Hampshire divisions, with headquarters at Concord, N. H. Mr. Hicks was holding this position at the time of his recent promotion to track supervisor.

C. A. Maxeimer, assistant division engineer on the St. Lawrence division of the New York Central, with headquarters at Watertown, N. Y., has been promoted to supervisor of track on Subdivision 19 of the St. Lawrence division, with headquarters at Carthage, N. Y., where he succeeds **George W. Clark,** who has been transferred to Subdivision 5 of the Mohawk division, with headquarters at Albany, N. Y. Mr. Clark succeeds **J. E. Egan,** who has been transferred to Subdivision 1 of the Electric division, with headquarters at New York, succeeding **C. E. Doty,** whose death is noted elsewhere in these columns. **A. S. Williams,** a track foreman on the St. Lawrence division, with headquarters at Adams, N. Y., has been promoted to assistant supervisor of track on Subdivision 17 of the St. Lawrence division, with headquarters at Watertown, N. Y., succeeding **F. E. Ladd,** whose promotion to assistant division engineer is noted elsewhere in these columns. **Vernon Proper,** a track foreman on Subdivision 8 of the Syracuse division, has been appointed assistant supervisor of track on Subdivision 31 of the Mohawk division, with headquarters at Malone, N. Y., succeeding **E. F. Anderson,** who has been transferred to Subdivision 10 of the Mohawk division, with headquarters at Rochester, N. Y. Mr. Anderson succeeds **J. H. Peltier,** deceased.

Mr. Maxeimer, who was born on October 18, 1894, at Albany, N. Y., and received his higher education at Cornell University, began his railroad career as a laborer on the New York Central, on June 24, 1916. On August 29 of the same year he was promoted to rodman, and on April 1, 1918, he was further advanced to draftsman. During the next seven years, Mr. Maxeimer held the positions of rodman, chainman, transitman and draftsman for various periods and at various points, and on June 1, 1925, he was promoted to assistant supervisor of track on the Mohawk division, with headquarters at Fonda, N. Y. On December 1, 1925, he was transferred to the Syracuse division at Oneida, N. Y., and on October 1, 1927, he was promoted to assistant division engineer on the old Ontario division, with headquarters at Oswego, N. Y. On July 1, 1930, he was transferred to the St. Lawrence division at Watertown, N. Y.

Bridge and Building

J. C. Bardin has been appointed superintendent of scales of the Texas & Pacific, with headquarters at Dallas, Tex., to succeed **T. O. Dean,** whose death is noted elsewhere in these columns.

C. L. Lowell, bridge and building foreman on the Mohawk division of the New York Central, with headquarters at Malone, N. Y., has been appointed bridge and building inspector on the same division, with the same headquarters, to succeed **A. C. Tanner,** whose headquarters were at Albany, N. Y. Mr. Tanner has been appointed assistant supervisor of bridges and buildings on the St. Lawrence division, with headquarters at Watertown, N. Y., succeeding **E. E. Tanner,** who has been transferred to the Buffalo division with headquarters at Rochester, N. Y., to succeed **E. J. Rykenboer,** retired.

John W. Gannon, assistant supervisor of bridges and buildings on the Terminal

division of the Boston & Maine, with headquarters at Boston, Mass., has been promoted to supervisor of bridges and buildings on the New Hampshire division, with headquarters at Concord, N. Y., to succeed **Herbert C. McNaughton,** who has been transferred to the Fitchburg division, with headquarters at Greenfield, Mass., to succeed **John E. Buckley.** Mr. Buckley has been appointed assistant supervisor of bridges and buildings, with the same headquarters, succeeding **Everett A. Greene,** who has been assigned to other duties. **Ernest M. Stromvall,** a member of the Terminal Division engineering corps, has been promoted to assistant supervisor bridges and buildings on the Terminal division, with headquarters at Boston, to succeed Mr. Gannon.

Obituary

T. O. Dean, superintendent of scales of the Texas & Pacific, with headquarters at Dallas, Tex., died on April 21.

C. E. Doty, supervisor of track on Subdivision 1, Electric division, of the New York Central, with headquarters at New York City, died on April 19, at his home in Yonkers, N. Y.

J. H. Peltier, assistant supervisor of track on Subdivision 10 of the Mohawk division, New York Central, with headquarters at Rochester, N. Y., died on April 29, at his home in Lyons, N. Y.

Joseph T. Richards, formerly chief engineer maintenance of way of the Pennsylvania, who retired in 1915 as consulting engineer of maintenance of way of this road, died suddenly at his home at Cape May, N. J., on May 17, at the age of 88 years. Mr. Richards was born near Rising Sun, Md., on February 12, 1845, and was educated at West Nottingham Academy. He entered the service of the Pennsylvania in August, 1869, as a rodman at Altoona, Pa., and in the following year he was appointed a main line supervisor. From 1871 to 1873 Mr. Richards served as chief engineer of construction and superintendent of various railways in Maryland, and in the latter year he became engaged as an engineer on surveys for the Southern Pennsylvania route of the Pennsylvania, then being appointed acting supervisor on the Bedford division. In 1875 he became a civil and mining engineer wth the Cambria Iron Company, Johnstown, Pa., returning to the Pennsylvania later in the same year as assistant engineer maintenance of way. In 1877 Mr. Richards was appointed principal assistant engineer maintenance of way of the United Railroads of New Jersey division and from March, 1883, to June, 1885, he was assistant to the chief engineer of the Pennsylvaia, being advanced to assistant chief engineer at the end of this period. Eight years later he was appointed engineer maintenance of way and on June 1, 1903, he was made chief engineer maintenance of way, with jurisdiction over all lines east of Pittsburgh, Pa., Erie and Buffalo, N. Y. In 1914 he was appointed consulting engineer of maintenance of way, holding this position until his retirement in 1915.

Supply Trade News

General

The Republic Steel Corporation has moved its Dallas, Tex., district sales office to 2322 Gulf building, Houston, Tex.

The Positive Rail Anchor Company has moved its Chicago sales office from 80 East Jackson boulevard to the McCormick building, 332 South Michigan avenue.

The Chicago sales office of the universal pipe division of the **Central Foundry Company,** New York, is now located at 1629 Wellington street, Chicago.

Morrison Metalweld Process, Inc., Buffalo, N. Y., has moved its Chicago office from its Chicago plant to the Great Northern building, 20 West Jackson boulevard.

The Worthington Pump & Machinery Corporation has moved its general and executive offices from 2 Park avenue, New York, to its new office building adjacent to the corporation's plant at Harrison, N. J., which was opened on May 1. The local sales office will be continued at 2 Park avenue, New York.

The Bucyrus-Erie Company, South Milwaukee, Wis., has acquired the drill business of the **Armstrong Manufacturing Company. George R. Watson,** formerly president of the Armstrong Manufacturing Company, has become associated with the Bucyrus-Erie Company and is in charge of the drill business.

The Wood Preserving Corporation, Koppers building, Pittsburgh, Pa., has established an operating unit, which will be supervised by **Reamy Joyce** and **Sherman S. Watkins,** formerly of the Joyce-Watkins Company, Chicago. The activities of Messrs. Joyce and Watkins will be principally in connection with the Baltimore & Ohio crosstie production and in the operation of the Green Spring, West Va., treating plant.

Personal

Milton Markley, representative of the Rail Joint Company, New York, for the New York-Philadelphia territory, with headquarters at Harrisburg, Pa., died in a hospital at Harrisburg, on May 1.

Neil C. Hurley, chairman of the executive committee of the **Independent Pneumatic Tool Company,** Chicago, has been elected president, to succeed **R. S. Cooper,** who has been made vice-president in charge of the eastern territory, with headquarters at New York, succeeding **Robert T. Scott,** retired.

C. S. Clingman, manager of the southwestern division of the transportation and government department of the **Johns-Manville Sales Corporation,** with headquarters at St. Louis, Mo., has been appointed sales manager of the western region, transportation and government department, with headquarters at Chicago, succeeding **John H. Trent,** promoted. **A. C. Pickett** has been appointed manager of the southwestern division of the transportation and government department at St. Louis, succeeding Mr. Clingman.

F. D. Foote has been appointed assistant to the commercial vice-president of the **United States Steel Corporation,** New York, in which position he will be responsible for the co-ordination of sales efforts affecting the railroads and the railroad equipment industries. **E. P. Brooks,** formerly of the sales executive staff of Sears Roebuck & Company, has also been appointed assistant to the vice-president, with headquarters at New York.


F. D. Foote

Mr. Foote was born on December 16, 1892, and became associated with the Greenville Steel Car Company as purchasing agent in 1912. Four years later he became a director and secretary and treasurer of the company, and in 1924 was elected president. When the Greenville Steel Car Company became a subsidiary of the Pittsburgh Forgings Company in January, 1930, Mr. Foote became vice-president of the latter company, retaining the presidency of the Greenville Steel Car Company. In March, 1932, he became president of the Pittsburgh Forgings Company, which position he held until he became associated recently with the United States Steel Corporation, as an assistant to C. L. Wood, commercial vice-president. Mr. Foote has served for several years as a director of the American Railway Car Institute.

Trade Publications

The New Story of Ancient Wrought Iron.—A. M. Byers Company, Pittsburgh, Pa., has issued an attractively-illustrated booklet of 16 pages, defining and describing genuine wrought iron and explaining the new quantity production process for the manufacture of this material, with the aid of eight half-page illustrations. A table of the chemical constituents of wrought iron is set off on one page with a background comprising a reproduction of a photomicrograph of wrought iron.

ALPHABETICAL INDEX TO ADVERTISERS

1933

ah

HIO

S